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ABSTRACT

The problems of deferred maintenance and decaying campus infrastructure have troubled higher education for the past two decades. This book, designed to be a tool for facilities managers, describes a process for inspecting and reporting conditions of buildings and infrastructure. The audit process is meant to be a routine part of maintenance management so that application of the techniques described can be part of predictive methods of determining facilities management requirements and capital renewal and replacements programs. The first chapter introduces the facilities audit covering its purpose, structure, uses, users, how it relates to capital asset management, terminology, and how to adapt it for local needs. The process of preparing for an audit is described in chapter 2 including the program, the conditions inspection process, and use of functional performance evaluations. Chapter 3 discusses the design of the audit including determining its scope, selecting the audit team, planning the inspection, and information requirements. Data collection is covered in the fourth chapter which discusses conducting inspections and the inspection report forms. Chapter 5 is on summarizing inspection results including evaluating the inspection program, preparing summary reports, and planning future audits. The sixth chapter is on the final step of the audit process, presentation of the audit to management and others. Chapter 7 describes capital renewal: putting the audit to work (capital renewal planning, project priorization, resource allocation, and funding/planning). The appendixes comprising half of the document provide 24 sample inspection forms and checklists. (Contains 140 references.) (JLC)

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The Facilities Audit

A PROCESS FOR IMPROVING FACILITIES CONDITIONS

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A PROCESS FOR IMPROVING FACILITIES CONDITIONS

by Harvey H. Kaiser

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ABOUT THE AUTHOR

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The author is indebted to the many users of the original *Facilities Audit Workbook* for reporting their experiences with the facilities audit and their improvements and modifications to inspection forms and audit techniques. Through correspondence, copies of surveys, and phone calls, colleagues have offered invaluable suggestions. I regret not consistently recording their names and institutions for appropriate recognition. My presentations at APPA's semiannual Institute for Facilities Management offered direct contact with users and innovators, yielding suggestions and comments that I incorporated into this book.

An important contributor to this book was Applied Management Engineering (AME) of Virginia Beach, Virginia. AME was helpful in showing how implementation of the audit could be imaginatively applied to field situations in *Managing the Facilities Portfolio* (1991), published by the National Association of College and University Business Officers. The firm's concepts of facilities condition assessment expanded the inspection of building conditions into a comprehensive method for evaluating and planning maintenance and capital renewal programs. The author also acknowledges the R.S. Means Co., Inc., which published some of the concepts included in this book in *The Facilities Manager's Reference* (1989).

Comments on manuscript drafts by experienced colleagues were extremely helpful in maintaining a perspective on the evolving use of facilities audits as part of comprehensive facilities management programs to manage higher education capital assets. They also reassured me that a departure in concept from the original workbook was valid and necessary. I am indebted to the following reviewers for their thoughtful comments: Robert G. Brooks Jr., Douglas W. Kincaid, and Robert Vaughan, Applied Management Engineering; Douglas K. Christensen, Brigham Young University; Sean C. Rush, National Higher Education Services, Coopers & Lybrand; Bruce W. Baugh, HTX International, Inc.; and Jack Hug and David A. Schlafman, University of California, San Diego. Special thanks go to Brenda N. Albright, Tennessee Higher Education Commission, and William S. Gardiner, The Colonial Williamsburg Foundation, who reviewed both the first and second drafts, adding to the importance of applying the results of audits to capital renewal programs.

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PREFACE

The burdensome problems of deferred maintenance and decaying campus infrastructure have troubled higher education for the past two decades. Recognizing these problems and alerting higher education to the implications of neglecting campus facilities have brought APPA: The Association of Higher Education Facilities Officers (formerly Association of Physical Plant Administrators of Universities and Colleges) into the forefront. Through its research and publications, in cooperation with other higher education associations, APPA has taken the lead in presenting the case for facilities renewal and providing the tools to address the challenging task.

In 1982, APPA, the Association of Governing Boards of Universities and Colleges, and the National Association of College and University Business Officers (with support from AT&T and IBM) published *Facilities Audit Workbook: A Self-Evaluation Process for Higher Education.* Widespread use of the workbook resulted in a second printing in early 1987. The original purpose of the workbook was to create a useful tool for assessing facilities conditions. The documentation contained in facilities audits responds to the need for specificity in evaluating campus facilities conditions and helps campus facilities managers present a case for funding. As a result of receiving cumulative information on facilities conditions, senior campus administrators, governing boards, foundations, and corporations have seen the need to identify capital renewal/deferred maintenance as a high priority for higher education.

Since the appearance of the original *Facilities Audit Workbook*, publications by APPA and other higher education associations have built on the basic premise of assessing conditions as a requisite for planning facilities renewal. Many campuses and systems of higher education, in the United States and abroad, have used the workbook as a basic planning tool for maintenance management and capital renewal. It has been widely adapted to fit campus conditions and serves as the groundwork for refinements in the process of evaluating conditions. These adaptations have shown that the workbook's principles are understood; its modification and expansion into a comprehensive technique for planning facilities renewal has assisted many campuses in developing deferred maintenance reduction programs.

Unmet financial needs for correcting deferred maintenance represent a major liability for many campuses. Estimates in the billions of dollars for renewal and replacement needs in all of higher education indicate that a renewed effort is necessary for identifying conditions, estimating costs for renewal, and planning programs to restore decaying campus facilities and infrastructure. Typically, first efforts to assess conditions revealed funding requirements far beyond the expectations of campus administrators. For some institutions, economic pressures have led to reductions in capital

renewal funding. The result is a compounding of deficiencies that dangerously threaten financial stability and handicap the institution's ability to satisfy its missions of teaching, research, and community service. Moreover, as colleges and universities must increasingly compete for students, faculty, and staff, the attractiveness of a campus has become an important feature in the struggle For some campuses, capital renewal is an act of survival.

This book builds on the original workbook's concepts but goes further by outlining a more powerful tool for facilities managers. The presentation retains an orientation to a self-evaluation process conducted by in-house staff, but it can also serve as a guide for consultants retained to conduct facilities inspections. The fundamental concept is that the inspection of facilities, analyzing physical and functional characteristics of building components, provides a data base for further analysis that supports a capital renewal and replacement program. Users of the original workbook will be familiar with this concept, recognizing that conditions were evaluated subjectively, producing qualitative condition ratings for components, building systems, and entire facilities.

After a decade of use, a facilities condition evaluation technique has evolved that emphasizes objective analysis and quantitative data. The reader will see that methods used in this edition follow a logical approach to analysis, identifying maintenance deficiencies and capital costs for remedying them.

In addition to the deficiency-cost approach exemplified in the data collection forms, the book provides guidelines for inspections and samples of completed forms. It includes inspection forms for infrastructure (roads, walkways, grounds, etc.), completing a comprehensive method of estimating campus maintenance and capital renewal needs. In recognition of the availability and power of personal computers for creating an audit data base, thoughtful design of inspection forms allows adaptation to word processing and spreadsheet programs. Evaluations and analyses are illustrated in summary reports that can be prepared manually or on a computer.

It is appropriate to restate the instructions for users in the original workbook:

> This workbook is designed to be used—but to be fully utilized, it must be adapted for use on your campus. Not every component, form, or procedure must be part of the facilities audit. This manual was created to be a sample only; there should be no hesitation by any institution to add to, amend, or delete from the materials presented.

Enhancements, deletions, or additions should be given careful consideration for the purposes of conducting a facilities audit. Inadequate efforts can hamper the use of audits as an effective tool for capital renewal/ deferred maintenance programs and maintenance management. Excessive information can be a burden in time and costs to the overall inspection program. Use the procedures and forms with reasonable judgment as part of a comprehensive process of inspecting your facilities programs and presenting your findings.

This book describes a process for inspecting and reporting conditions of buildings and infrastructure. I strongly urge you to go beyond a one-time study of conditions, and incorporate these techniques into routine inspections and reporting of facilities conditions. The audit process should be a routine part of maintenance management. Application of the techniques can be part of predictive methods of determining facilities maintenance requirements and capital renewal and replacement programs.

CHAPTER ONE

INTRODUCING THE FACILITIES AUDIT

What are the conditions of our facilities? Do we face a significant deferred maintenance problem? How much money will be needed to correct the problem? How do we plan a capital renewal program? These and other questions are becoming more routine as facilities managers and their superiors become more sophisticated and knowledgeable about capital asset management.

The facilities audit provides a source for identifying the existing physical condition and functional performance of buildings and infrastructure, as well as their maintenance deficiencies. From the information gathered during this audit, you can estimate capital renewal and replacement requirements for individual projects and annual forecasts. The facilities audit provides you with a basis for decision making on routine maintenance, capital renewal/deferred maintenance, functional improvements, replacements, and disposal of your institution's facilities. Using the audit to inspect building and infrastructure conditions helps with maintenance management and the prioritizing of projects for capital budgeting.

PURPOSE OF A FACILITIES AUDIT

The facilities audit systematically and routinely identifies facility deficiencies and functional performance of campus facilities through an inspection program and observation reports. The audit process helps maintenance management and the institution's decision makers recommend actions for major maintenance and capital renewal.

The audit is designed for use by facilities managers responsible for maintenance, capital renewal and replacements, and capital budgeting. Circumstances may differ for institutions that undertake a comprehensive survey of all facilities for the first time and those that have a specific set of goals for determining existing conditions. The basic principles presented here can be used at all levels, from a single structure to multiple building complexes in dispersed locations. A continuous process of facilities audits, rather than a one-time program, provides up-to-date major maintenance priorities and can generate a significant portion of routine maintenance workloads. An effective audit program will extend the useful life of facilities, reduce disruptions in use of space and equipment downtime, and improve relations between facilities management departments and facilities users.

AUDIT STRUCTURE

The audit is a process of collecting information on current conditions of a facility. A well-designed audit has the following goals:

- provide for a routine inspection of all facilities to identify deficiencies
- define regular maintenance requirements
- define capital renewal and replacement projects in order to eliminate deferred maintenance
- develop cost estimates to correct deficiencies
- restore functionally obsolete facilities to usable condition
- eliminate conditions that are either potentially damaging to property or hazardous to persons
- identify energy conservation measures
- inventory accessibility and disabled persons requirements

The basic phases of the audit process are shown in Figure 1. The first three phases— designing the audit, collecting data, and summarizing results— provide the data base on maintenance deficiencies and functional performance. These phases are followed by presentation of findings. In this systematic approach the scope of the audit is first determined, the audit team selected, and the inspection planned. Next, data are collected through inspection of buildings and infrastructure and functional performance evaluations. Finally, the information from these inspections and evaluations is summarized, priorities set, and results presented.

USES OF THE AUDIT

The audit is a method of collecting information on the current maintenance conditions and functional performance of a facility. It has been designed to include:

- inventory of facilities, providing descriptions of characteristics
- inspections of existing buildings and infrastructure conditions
- evaluations of functional performance
- recommendations for correcting observed deficiencies

The inspection process consists of systematic inspections of buildings and infrastructure by components, following the sequence of construction. Functional performance is evaluated for future planning purposes, capital renewal, and replacements. The methodology presented here can be implemented as is or adapted to meet special conditions and needs of an institution.

If an audit is designed in a comprehensive, easy-to-use format, it can be used:

- in the field without extensive training
- with or without consultant assistance
- at any institution, regardless of size

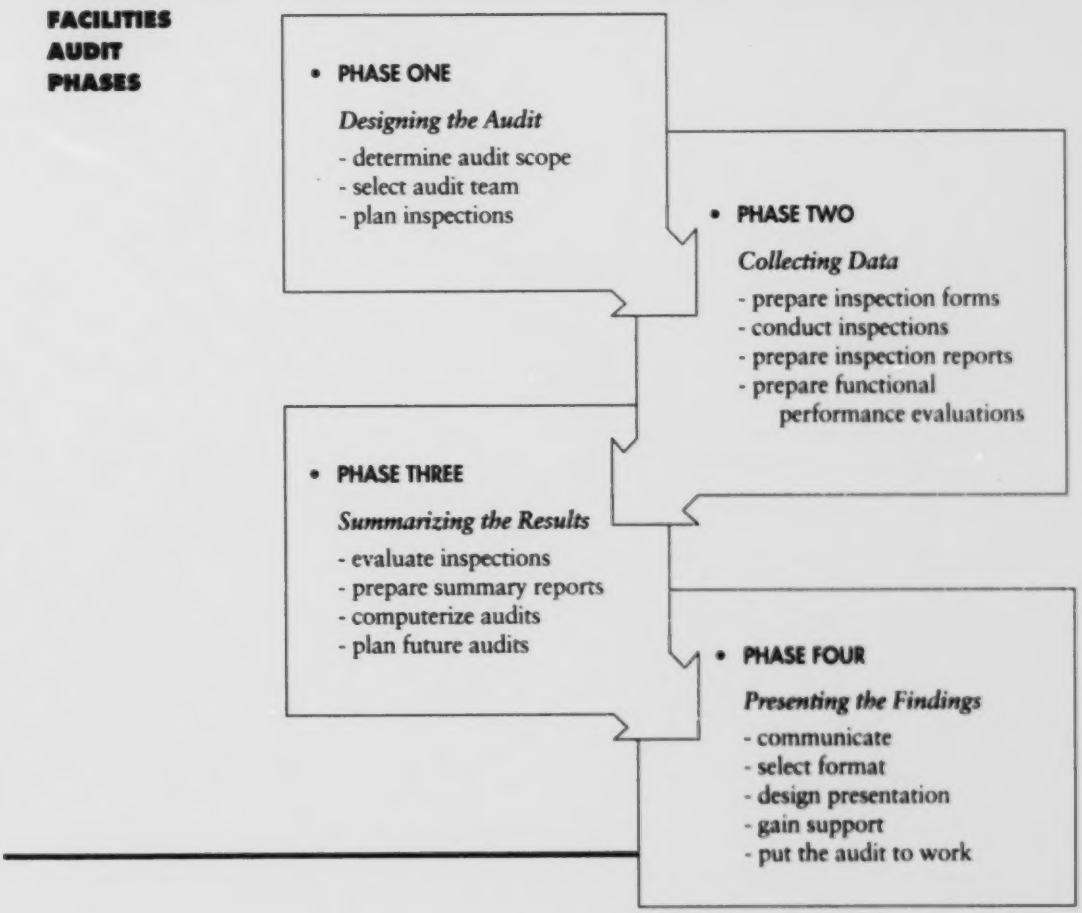
USERS OF THE AUDIT

The information gathered in the facilities audit will have several intended users and serve many different purposes:

- **Senior Campus Administrators.** The facilities audit supports a consistent presentation of facilities deficiencies, leading to better priority setting when funding is limited. Results also provide documentation for capital renewal and replacement requests.
- **Governing Boards.** The facilities audit provides information to governing boards concerned with the condition of buildings and infrastructure. The goals of long-term capital budgeting and planning to eliminate deferred maintenance and maintain facilities in usable condition are also served by the audit.

FIGURE 1

FACILITIES AUDIT PHASES



- **Facilities Managers.** The facilities audit provides information for routine maintenance, major maintenance, and capital renewal. The inspection procedures and forms can be the basis of a routine process for observing deficiencies and incorporating them into maintenance planning. The facilities audit also helps the facilities management staff communicate with the administration; facilities problems that were ignored in the past can be objectively presented to senior administrators in the facilities audit.

- **Team Specialists.** The facilities audit enables architects, engineers, and other specialists to gather data on building and infrastructure systems and components related to their disciplines. Information needs of the entire facilities team can be identified and used with more objectivity with the audit data; the audit should make it easier to study the overall building and infrastructure needs of the institution.

CAPITAL ASSET MANAGEMENT

A facilities audit process using the methodology presented here is one element of a comprehensive approach to an institutional capital asset management program. This approach leads to better planning of maintenance and capital expenditures, to protect and extend the life of capital assets. Frequently, lack of planning and limited funds create maintenance backlogs and unattended facilities deficiencies. These facilities deteriorate, resulting in deferred maintenance and a significant financial burden for corrective measures. Therefore, it is necessary to have a process—the facilities audit—that clearly identifies and quantifies the condition and functional performance of the physical plant and the cost of various options for correcting deficiencies.

Elements of a comprehensive capital management program are listed in Figure 2. The facilities audit is a component of the facilities management information data base. Developed as a source of a strategic facilities development plan, an audit is essential to define existing facilities conditions and assist in preparing a capital improvement plan.

TERMINOLOGY

The following terms are used in the comprehensive facilities audit program:

Capital Additions and Improvements.

Alteration and Renovation. Work that is required because of a change in use of the facility or a change in program.

New Contruction. Internal and external planning for new construction and small construction if funded out of current funds.

FIGURE 2

COMPREHENSIVE CAPITAL ASSET MANAGEMENT PROGRAM

A. STRATEGIC FACILITIES DEVELOPMENT PLAN

1. Physical development policy
2. Facilities management information data base
3. Facilities improvement plan

B. CAPITAL BUDGET PLAN

1. Project schedule
2. Funding source
3. Impact of proposed space changes
4. Project priority selection guidelines
5. Capital project programming and budgeting

C. FACILITIES MANAGEMENT PLAN

1. Operations and maintenance plan
2. Organization plan: facilities planning and operations
3. Space allocation procedures

Deferred Maintenance. Maintenance projects from prior years and the current year that were not included in the maintenance process because of perceived lower priority status than those funded with available funding. Deferred maintenance includes postponed renewal and replacement maintenance and unperformed unscheduled major maintenance.

Facilities Audit. A process for inspecting and reporting the physical condition and functional performance of building and infrastructure systems and components.

Facilities Components. The individual components that make up the structural, exterior enclosure, interior, mechanical, electrical, and safety elements of a building.

Facilities Renewal and Replacement Program. A systematic and cost-effective approach to planning and budgeting that extends the life and retains the usable condition of facilities and system, not normally covered in the annual operating budget, including but not limited to the following:

- deferred maintenance
- capital renewal and replacement
- facilities remodeling and renovation for functional improvements
- retrofitting for energy conservation
- elimination of health and life safety problems
- provisions for accessibility for persons with disabilities
- compliance with federal, state, and local regulatory requirements

Maintenance. The upkeep of buildings, grounds, utilities, and equipment to meet assigned missions. Categories of maintenance are defined for management and budgeting purposes based on a cycle of activity, scope of work, and funding allocation and sources. Common categories are described below:

Emergency Maintenance. The repair and replacement of property requiring immediate attention because the function of a critical system is impaired or because health, safety, or security of life or property is endangered. Emergency work supersedes all other categories of maintenance.

Planned, Routine, or Regular Maintenance. Routine repairs and replacements that normally recur on a more or less predictable basis. Routine maintenance does not involve major structural repairs or space alterations.

Preventive Maintenance (PM). The inspection and planned maintenance of buildings, grounds, utilities, and equipment for conditions that will lead to harmful breakdowns or damage, and any other appropriate actions to ensure continuous operation or maintenance at acceptable levels.

Major Maintenance Program. Projects of magnitude and cost such that funding is normally established on an individual basis from current funds. This category is defined by scope of work and source of funding and can be planned or unscheduled.

ADAPTING THE AUDIT

Although maintenance staff may collect and analyze some information to ensure the performance of buildings and infrastructure components, they do not typically collect planning data to assess long-term needs. The audit goes beyond maintenance planning. Using the audit procedures produces a data base of information on facilities that can be used as a baseline for future condition inspections.

The audit process is a thorough inspection of buildings and infrastructure, evaluation of functional performance, and reporting of observations. The process can be used as a guide for a self-evaluation program using in-house staff or for consultants. You should incorporate the special characteristics of your organization and its facilities into an individualized facilities audit. The forms presented later in this book are intended to serve as general guides; you should feel free to modify them to suit the needs of your building and infrastructure systems and components.

Careful design of a facilities audit enables you to predetermine the level of information to be obtained, and to be sure the information gathered is appropriate for the projected application of the findings. The selection of approach must be driven by the nature of your organization's facilities, budgeting methods, and organizational structure. Formats for reporting the audit findings should be tailored to match the input requirements for your maintenance work order system and capital budgeting and planning process.

As you and your staff gain experience with the facilities audit, you will recognize its potential for providing information on building and infrastructure condition, information for maintenance planning, and information for restoring and maintaining the physical and functional adequacy of facilities. The audit contributes to the overall effectiveness of the facilities management organization by making condition inspections a routine part of your operating activities.

CHAPTER TWO

PREPARING FOR A FACILITIES AUDIT

THE FACILITIES AUDIT PROGRAM

To be successful, a facilities audit program requires the support of senior financial and facilities management. Planning for an audit program should incorporate their review of the process and form of results to ensure that requirements are met for capital asset management planning and allocation of resources. Senior management involvement in facilities audit planning can result in reliable sources of information on the physical condition of the campus to determine funding needs.

Conducting a facilities audit requires a clear set of objectives before committing staff and financial resources. Whether a campus has previously conducted facilities audits or is beginning one for the first time, there should be thorough preparation to ensure understanding and support of all staff involved in the process. Management and inspectors must make a commitment to collect accurate data, identifying deficiencies as objectively as possible.

An audit can be comprehensive, collecting information on building and infrastructure components and functional performance for all facilities; or it can be limited to a condition inspection program, eliminating the functional performance evaluation. It can also be selective for specific components of buildings, such as roofs, or a collection of information for safety or to meet new regulatory requirements.

Audit results are used to plan routine and major maintenance, urgent and long-term measures to correct facilities conditions through a deferred maintenance reduction program, and capital renewal and replacement budgeting and planning. For example, audit forms can be used to provide a description of conditions for an auxiliary enterprise, such as residence halls or athletic facilities. The audit methodology can also be applied for a survey of one or more components for which information is needed because of legal compliance requirements to meet new regulations or codes.

CONDITION INSPECTIONS

Condition inspections are designed to provide a record of deficiencies and estimated costs to correct them. The deficiency-cost methodology requires training inspectors for a "self-audit" (or giving clear instructions to consultants) to produce an objective and consistent data base for future reference. Incorporated into the training is the development of a process of continually observing and reporting deficiencies, flowing results into maintenance work and capital budgeting and planning. A successful audit program will introduce a culture of observing and reporting conditions not on a one-time basis, but as a regular part of supervisory and tradespeople's work.

The condition inspection part of a facilities audit is a visual inspection of buildings and infrastructure systems and components. Design of the inspection forms and methodology of the audit approach are based on how a building or infrastructure is constructed and how inspectors would logically proceed to make observations and collect data on deficiencies and costs of corrective measures. Building inspections begin with how a structure is placed in the ground, then travel upward to structural framing, exterior wall enclosures, and roof, and then move to the interiors. Each service system—heating, ventilation, and air conditioning (HVAC), plumbing, electrical—is inspected separately. A comprehensive audit includes an inspection of architectural, civil/structural, mechanical, electrical, and safety components of each facility. Infrastructure inspections are conducted in a similar, methodical manner.

Figure 3 outlines the systems and components covered in building and infrastructure inspections. References used for developing this outline are R.S. Means Company, Inc., *Means Graphic Construction Standards* and *Means Cost Data* (annual editions). Refer to these publications for an understanding of alternative component definitions and cost data for estimating costs of correcting deficiencies.

As shown in Figure 3, primary systems include foundation, structural system, exterior wall system, and roofing system. Secondary systems include interior work that makes the facility usable: ceilings, floors, interior walls and partitions, and specialties. Service systems include all operating systems, such as HVAC, plumbing, and electrical systems. Safety standards, including life safety and code compliance, are grouped together. Decisions on where to record data for a unique system or alternatives to the component definitions in this book are flexible and should be made during the initial organization of the audit and instructions to inspectors.

Major infrastructure components are listed in groups that can be inspected by appropriate specialized staff or consultants. These lists should also be reviewed and flexibility retained until a final list is adopted.

FIGURE 3

BUILDING AND INFRASTRUCTURE COMPONENT DESCRIPTIONS

BUILDING COMPONENT DESCRIPTIONS

PRIMARY SYSTEMS

1. Foundation and Substructure
   - Footings
   - Foundation walls
   - Grade beams
   - Insulation
   - Slab on grade
   - Waterproofing and underdrain
2. **Structural System**
   - Floor system
   - Roof system
   - Platforms and walkways
   - Pre-engineered buildings
   - Stairs
   - Structural framing system
3. **Exterior Wall System**
   - Chimneys and exhaust stacks
   - Entrances
   - Exterior doors and frames
   - Exterior walls
   - Exterior windows
4. **Roof System**
   - Flashings, expansion joints, and gravel stops
   - Gutters and downspouts
   - Insulation
   - Roof hatches, smoke hatches, and skylights
   - Roofing

SECONDARY SYSTEMS

5. **Ceiling System**
   - Directly applied systems
   - Exposed structural systems
   - Suspended systems
6. **Floor Covering System**
   - Floor finishes
7. **Interior Wall and Partition Systems**
   - Hardware
   - Interior doors and frames
   - Interior walls
   - Interior windows
   - Special openings: access panels, shutters, etc.
   - Toilet partitions
8. Specialties (examples)
   - Bathroom accessories
   - Kitchen equipment
   - Laboratory equipment
   - Projection screens
   - Signage
   - Telephone enclosures
   - Waste handling
   - Window coverings

SERVICE SYSTEMS

9. **Heating, Ventilating, and Air Conditioning Systems**
   - Air handling units
   - Boilers
   - Computer room cooling
   - Cooling tower
   - Ductwork and piping
   - Fan coil units
   - Fans
   - Heat pump
   - Packaged rooftop air conditioning units
   - Packaged water chillers
   - Radiation
   - Solar heating
10. **Plumbing System**
    - Controls
    - Drinking fountains
    - Piping, valves, and traps
    - Plumbing fixtures
    - Pumps
    - Sprinkler systems
    - Water storage
11. **Electrical Service**
    - Cable trays
    - Cables and bus ducts
    - Conduits
    - Duct bank
    - Panelboards
    - Switchboard
    - Switchgear
    - Substations

FIGURE 3, *continued*

Transformers
Underfloor raceways
Underground and overhead service

12. **Electrical Lighting**
Baseboard electric heat
Emergency/standby power
Lighting fixtures
Lightning protection
Motor controls
Motors
Safety switches
Telecommunications and data
Wiring

13. **Conveying Systems**
Dumbwaiters
Elevators
Escalators
Material handling systems
Moving stairs and walks
Pneumatic tube systems
Vertical conveyors

14. **Other Systems**
Clock systems
Communications networks
Energy control systems*
Public address systems
Satellite dishes
Sound systems
TV systems

SAFETY STANDARDS

15. **Safety Standards**
Asbestos
Code compliance
Detection and alarm systems
Disabled accessibility**
Egress: travel distance, exits, etc.
Emergency lighting
Fire extinguishing and suppression
Fire ratings
Hazardous/toxic material storage

* Energy audit
** Accessibility audit

INFRASTRUCTURE COMPONENT DESCRIPTIONS

1. **Site Work**
Curbing
Fencing
Parking lots
Roads
Walks
Water retention

2. **Site Improvements**
Furniture: benches, bike racks, waste receptacles, kiosks, signage
Landscaping
Lighting

3. **Structures**
Bridges
Culverts
Retaining walls
Tunnels

4. **Utilities**
Central energy plants
Chilled water distribution
Compressed air
Distilled water
Domestic water
Electrical distribution
Energy monitoring and control
Fire protection
Irrigation
Sanitary sewage
Steam distribution
Storm drainage
Water treatment and distribution
Wastewater treatment and collection

FUNCTIONAL PERFORMANCE EVALUATIONS

Completing the data base with an analysis of facilities' functional characteristics provides a useful tool for renovation or planning alternative uses of facilities. Before you summarize the results of the condition inspection, you should evaluate the functional performance of a facility, such as suitability, adaptability, and use considerations.

For example, in the condition inspections, a building may be found to have significant deficiencies with costs of corrective measures exceeding replacement value. However, for historic, aesthetic, or other reasons, the building may be retained for remodeling and extended use. Major renovations resulting from functional performance evaluation may include all identified priorities in a single improvement program. On the other hand, a facility may be considered for remodeling, but your institution may want to recommend demolition because of conflicts with plans for future land use or sale as a source of revenues.

CHAPTER THREE

DESIGNING THE AUDIT

The first phase, designing the audit, includes

- determining audit scope
- selecting the audit team
- planning the inspections

The items that make up each of these steps are listed in Figure 4.

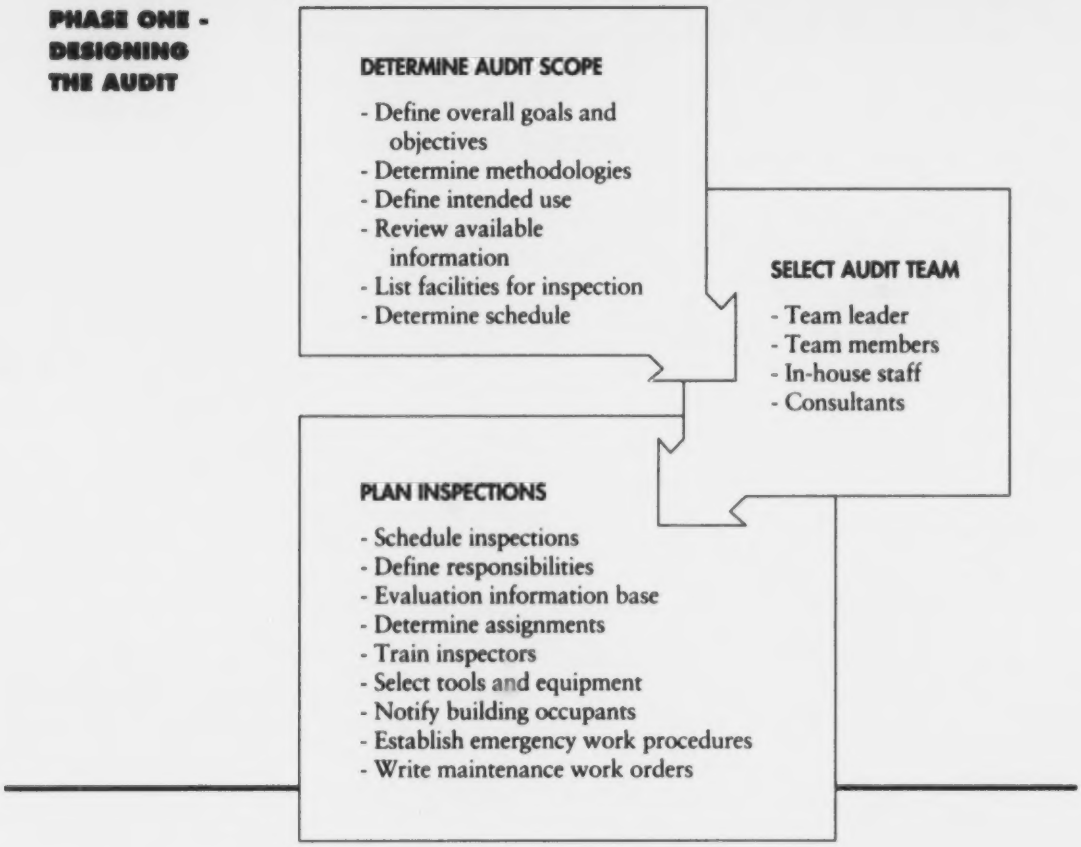
Building and infrastructure inspections can represent a significant commitment of resources. The audit design should be prepared to adjust staff schedules for in-house inspectors and allow adequate time for managing consultants when they are used. Direct costs must be budgeted for reproducing plans, preparing building histories, conducting laboratory tests, and producing other information. If you use consultants, their costs must also be budgeted. Thorough preparation, including staff training, will ensure the usefulness of facilities audit results.

DETERMINING THE SCOPE OF THE AUDIT

An audit's scope is determined by goals and objectives for conducting condition inspections, methodology for inspections and assessment, functional performance evaluations, and intended use of audit results. The choice of specific facilities to be inspected depends on the audit's goals and is often influenced by deadlines, availability of resources (staff and budgets), building access, and seasonal conditions. In determining the scope of the audit, keep in mind that inspection methodology produces quantitative information on building and infrastructure deficiencies and the costs of correcting them. Information obtained from inspections should be tailored to staff ability and time to analyze results and implement corrections. Review the following checklist to determine an audit's scope:

- ❑ Define goals and objectives of the audit
- ❑ Determine the methodology for inspections and assessments
- ❑ Define the intended use of results, and determine report formats
- ❑ Review available information on facilities to be inspected
- ❑ Prepare preliminary outline of facilities and components to be inspected
- ❑ Establish deadlines, availability of staff, and access to facilities

FIGURE 4



The goals and objectives for conducting building and infrastructure inspections will determine the audit's scope. Objectives can include setting priorities for major and minor maintenance, evaluating deferred maintenance reduction programs, and providing cost estimates for capital renewal and replacement.

Initiating a capital renewal planning program on a campus requires establishing a data base of conditions for all buildings and equipment. A request for information on a single building or building type (e.g., residences, laboratories, athletic facilities) will limit the scope of the audit. The need for information on one building or one infrastructure component (e.g., roofing, paving, or accessibility) will limit the scope still further.

Methodology for inspection and assessment includes choosing the forms to be used and deciding whether to use staff or consultants or both. Defining the use of information and planning how to computerize inspection results at an early stage of the process can eliminate the need to redo work. The intended results should be defined and final report formats designed to ensure that adequate inspection data are collected and usable analyses can be prepared.

FIGURE 5

BUILDING INVENTORY LIST

BUILDING #	BUILDING NAME	BUILDING LOCATION/ ADDRESS	OWNERSHIP O/L/O-L

A Building Inventory (Figure 5) lists buildings to be included in the audit and guides planning for staff resources and overall scheduling of inspections. You must decide whether to include all buildings in use (owned and leased) or only owned buildings. Forms should be prepared listing all buildings and infrastructure that will eventually be inspected and noting omissions from the audit. The inspection requires basic information on all buildings and infrastructure for use in the inspection process and later for developing summaries of information. Another element of the inventory is a Building File, containing useful data on each inspected facility (Figure 6).

FIGURE 6

BUILDING FILE

BUILDING DATA

1. Building # _____ 2. Building Name _____
3. Address _____
4. Grid Location _____ 5. Use _____
6. # Floors _____ 7. Gross Area (sq. ft.) _____
8. Net Assignable Area (sq. ft.) _____
9. Ownership ___ (O) ___ (L) ___ (O/L)
10. Book Value $_____ 11. Replacement Value $ _____
12. Age (Original construction, additions) _____

LAND DATA

1. Location _____
2. Ownership ___ (O) ___ (L) ___ (O/L)
3. Book Value $_____ 4. Current Market Value $ _____
5. Year(s) Acquired_____ 6. Area (acreage, sq. ft.) _____

NOTES: _____

Next, the outline of building and infrastructure systems and components (Figure 3) should be reviewed to determine the scope of the audit. Items may be added or deleted from the elements included in each component. They may also be shifted from one component to another to fit the qualifications of inspection team members.

Finally, an overall completion date or any deadlines for completing inspections and assessing results should be factored into the scope of the audit to ensure timely completion of accurate reports. Thorough planning of inspections enables observed deficiencies and costs for corrective measures to flow directly into work orders and capital budgets. Functional evaluations of facilities should also be included in the audit to assist in future planning and evaluating improvements for program activities.

SELECTING THE AUDIT TEAM

Once the audit scope has been determined, the audit team leader and team members are selected. The audit must be supervised to guide the process from start to finish. An audit manager should be identified to organize the process, supervise preparation of a data base of pertinent information, select audit team members, and schedule the audit. The manager should be able to prepare written reports, skilled in inspection techniques, capable of estimating and planning, and knowledgeable about maintenance practices and standards.

Members of the audit team should have technical backgrounds in architectural/civil, mechanical, electrical, and safety disciplines. Familiarity with facilities operations and maintenance or facilities management is essential, to ensure that inspections and assessments have the practical elements necessary for application to work orders and capital projects. Knowledge or skills in installation and maintenance of a component are important considerations in selecting an inspector or evaluating qualifications of a consulting team.

There are advantages and disadvantages to use of in-house staff or consultants.

In-house personnel are most familiar with facilities to be inspected. Maintenance supervisors or facilities planning staff who work with facilities on a routine basis have access to operations and maintenance information and can readily use that existing knowledge of deficiencies. However, the conflict of performing routine assignments often places in-house staff in the role of part-time inspectors, who must defer inspection assignments on interrupt scheduled tasks. Training can overcome lack of inspection experience and provide uniformity and consistency of inspections. Careful training of in-house staff contributes to the success of an audit and should be done formally, covering the inspector's role and importance of the inspection; use of forms and results; inspection techniques; and completion of inspection forms.

Consultants are recommended when in-house staff with adequate inspection skills or time are not available. Consultants can complete an audit on a timely basis and produce objective inspections and reports while leaving in-house staff free to perform their assignments. Consultants can offer specialized technical knowledge for diagnosing problems, recommending corrective measures, and estimating maintenance and capital projects. The audit scope must be carefully defined to manage costs and ensure that results meet goals and objectives. A staff audit manager should be appointed to coordinate consultants' inspection techniques, access to facilities, reports, and findings. Consultants' work should be organized to ensure that future audits can follow a similar format, providing information usable as a data base for comparability in future inspections.

PLANNING THE INSPECTION

Thorough planning of the building and infrastructure component inspections is essential to produce accurate, timely, and useful results. There are several critical factors to be considered in planning inspections.

Scope of audit

Specific buildings, infrastructure, systems, and components should be designated to ensure that inspections satisfy the audit's goals and objectives.

Scheduling inspections

An overall timetable for inspecting facilities translates goals and objectives into a framework for individual buildings and infrastructure. A specific budget cycle may be the driving force; strategic planning with a need for financial and physical resource components can also be the impetus for a facilities audit. The level of staff effort or need to retain consultants is determined by

- the overall inspection timetable
- number of facilities, size, age, and type to be inspected
- staff availability
- access to facilities influenced by usage and seasonal weather
- information available on the facilities
- nature and extent of involvement with key building personnel, especially research staff

An ideal audit program inspects all buildings and infrastructure components on an annual basis for budget planning and to keep surveys of deferred maintenance current. Resource limitations may make this goal unattainable. An initial audit should cover all facilities, regardless of resources, and be maintained on a cycle of at least two to five years. The initial audit can be extended over several years by inspecting some facilities each year; *inspections are a continuous process, not a one-time activity.*

An audit program on a continuing basis should become a fundamental activity of plant operations and maintenance, generating a large share of annual maintenance workload and providing an accurate list of capital renewal projects. Your ability to process and implement inspection data will help you to manage the flow of audit information into maintenance work orders and capital renewal/deferred maintenance planning.

The final step in scheduling inspections is estimating the time required to inspect each facility. Each discipline involved should be considered, as should preparation of drawings, facility access, and pertinent operating and maintenance information. Include enough time for preliminary discussions with building occupants or a survey soliciting information on conditions. The primary use of a facility will determine the time required for an inspection. Guidelines for an inspection timetable are described in NACUBO's *Managing the Facilities Portfolio*, derived from Department of Navy standards (*NAVFAC Manual MO-322, Inspection for Maintenance of Public Works and Public Utilities*). Approximately equal time will be required for conducting inspections and preparing inspection reports.

Responsibility

An audit manager must take overall responsibility for the inspection process, whether conducted by in-house staff, consultants, or a combination of both. The importance of this task is emphasized by allocating the majority of the manager's time to the assignment. The manager maintains control of the audit process by establishing the position as the primary contact in facilities management for the inspection teams. The manager should inform building managers and the business office of the inspection schedule and guidelines for inspectors. The manager also develops and supervises training for the inspectors, prepares the inspection schedule, assigns audit team members, monitors progress, and reports audit findings and recommendations.

INFORMATION REQUIREMENTS FOR INSPECTIONS

Planning the inspections includes developing an information base for each facility to be inspected. The audit manager is responsible for assembling information and supervising a central location that serves as audit headquarters, containing files, equipment, and access to copying machines and computers. The following is a suggested list for an inspection information base:

- facilities inventory (Figure 5, Building Inventory)
- building file (Figure 6)
- maps with grids
- building plans
- infrastructure plans
- project list and status of renovations, additions, and capital renewal
- maintenance cycles: preventive, painting, equipment replacement
- inspection report information: priority criteria, craft codes, labor rates, and estimating sources
- codes and other regulatory requirements
- building contacts: coordinators, managers, etc.
- access: keys, restricted areas, and safety precautions for hazardous conditions
- testing services: procedures for any specialized testing or laboratory services

Inspection assignments

In-house inspectors are assigned building or infrastructure systems and components by the audit team manager. Disciplines should be matched with the inspection assignment. For example, primary systems inspectors can be a team with architectural and civil skills. It is preferable to have two or more staff members inspecting a facility together for safety reasons and to improve communications between inspectors in identifying and diagnosing problems, selecting priority classifications, and estimating costs.

Training

Training both in-house inspectors and consultants on the inspection's purpose, schedule, and use of the forms is essential to ensure uniform and accurate results. Knowing why, when, and how the audit is to be conducted contributes to the quality of inspection results and develops interest and enthusiasm for incorporating inspections and reporting maintenance deficiencies as a regular part of plant activities. Recognize that staff may consider the audit an additional burden to their normal assignments. The leadership of the facilities management department and the audit manager should impress on the inspectors the importance of their tasks and their contribution to the organization's overall operation and mission.

During training, objectivity in conducting inspections should be emphasized as critically important. Conscientious staff, naturally protective of their areas of responsibility, should be encouraged to reduce subjectivity in conducting inspections. When consultants are scheduled to conduct inspections, they should be sensitive to in-house staff during the process of critically identifying conditions.

Well-prepared training sessions in the use of the inspection forms assist in completing a successful audit program, guiding the thoroughness of an inspection, and reporting results. Team members should be encouraged to share inspection results with other members and to question maintenance personnel about any known building or infrastructure deficiencies. They should also be regularly informed of any management actions resulting from the audits, annual reports, or other summaries. A training program can cover the following points:

- purpose of the audit
- availability of information
- inspector's responsibilities
- maintenance standards
- health, safety, and building codes
- field notes, use of cameras and video recorders
- use of forms
- describing deficiencies
- estimating maintenance and capital renewal
- use of results

Tools and equipment

To perform an inspection efficiently the inspectors should be prepared to spend a day in the field without returning to the base of operations unnecessarily. The following list of tools and equipment will ensure that the inspector is well prepared for assignments:

- adjustable wrench
- camera with flash (optional) or video recorder
- flashlight
- floor plans
- knife

- portable tape recorder (optional)
- report forms
- screwdriver
- tape measure

Notifying building occupants

Building occupants or users of infrastructure must be notified of a scheduled inspection. A preliminary discussion with users or a survey soliciting information can identify many problems prior to the inspection. Access to the building or any planned service disruptions for testing should be coordinated to avoid interrupting normal operations. Tours while a building is occupied are useful to uncover deficiencies and consider corrective measures. Care should be taken to avoid implying that inspections and identification of deficiencies will result in a specific program of remedial actions. Inspection results and any management actions on maintenance or capital renewal should be shared with building managers.

Emergency work

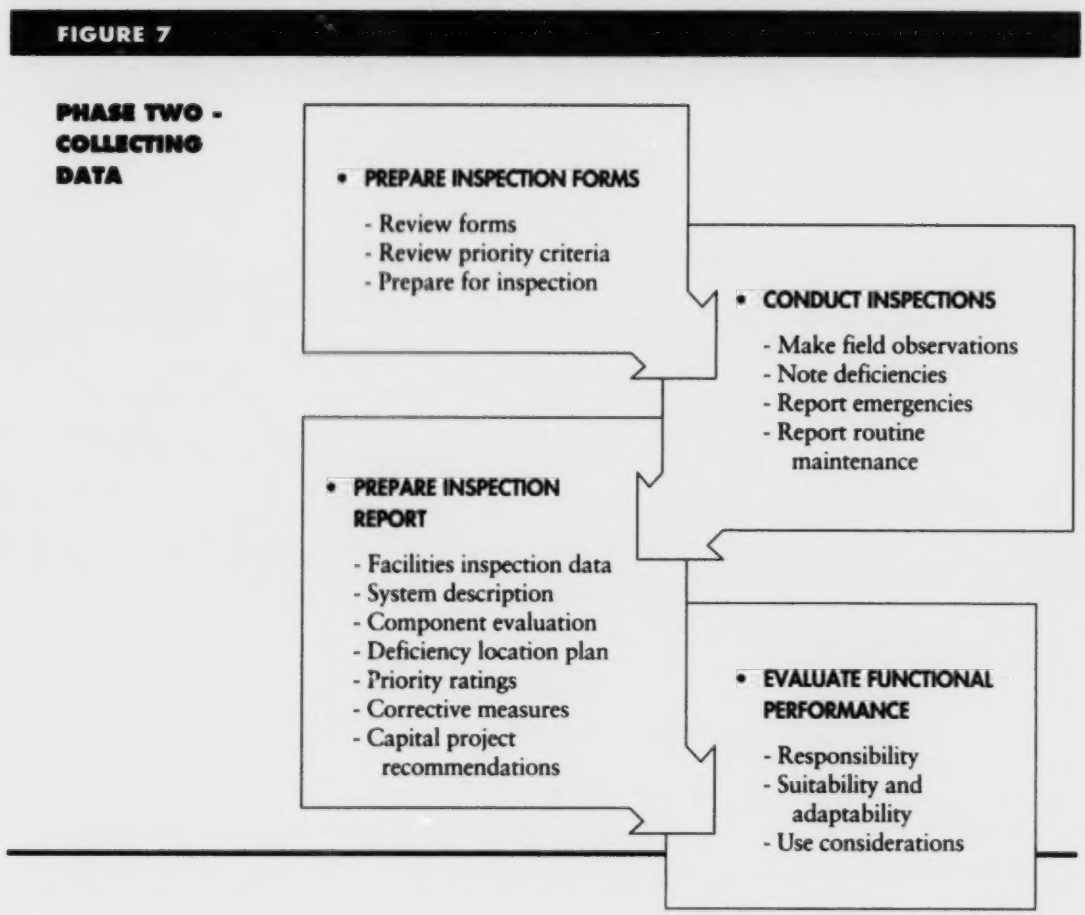
Procedures should be in place for promptly remedying any emergency conditions observed during the inspection. Audit team members should be instructed in these procedures during training.

CHAPTER FOUR

COLLECTING THE DATA

The second phase of the audit is collecting the data by building and infrastructure components and preparing inspection reports. The items that make up this phase are listed in Figure 7.

FIGURE 7



INSPECTION REPORT FORMS

Data collection for the facilities audit in the deficiency-cost methodology uses a standard inspection form that is completed for each of the suggested fifteen building and four infrastructure components outlined in Figure 3. The design of a standard form as shown in Figure 8 imposes a consistency on the inspection process, leaving flexibility for modifications to the number of components or terminology.

A complete set of forms for the building and infrastructure components is illustrated in Appendix A. Each form is accompanied by a checklist to guide the component inspection. PREPARE AND CAREFULLY REVIEW THESE FORMS. THEY ARE THE CORE OF THE INSPECTION PROGRAM.

Before the actual inspection begins, the audit manager prepares the form(s) and orients the inspectors. The audit manager completes part 1 of the form. The audit manager also reviews the checklist for information, inspection tools and equipment, notification to building occupants, access arrangements, and safety procedures at this time. Any questions by inspectors on making field notes, noting deficiencies on drawings, recording observations by camera or video recorder, and completing the forms should also be discussed. The inspectors should clearly understand the inspection schedule and the two-stage inspection process: 1) conducting the field inspection and recording field observations, and 2) preparing a report of the observations.

Review the sample forms and component inspection guidelines in the appendix. The inspection guidelines have been assembled from experience in conducting inspections and have proved useful in developing an audit program tailored to specific needs of an institution. Members of the audit team should review the component inspection guidelines.

CONDUCTING THE INSPECTION

Building and infrastructure inspections provide observations of conditions to be summarized on inspection report forms for individual components. The inspection thoroughly examines each component and documents all deficiencies requiring corrective measures. In a deficiency-cost audit, the inspector has the responsibility to record deficiencies, assign a priority, and estimate the cost for corrective measures.

Inspectors should use the component form as a guide in making field notes describing deficiencies and defining corrective measures. Photographs or video recordings can supplement the inspectors' field notes. Drawings of building floor plans or infrastructure installations should be used to note the location of the deficiency. Each deficiency is assigned a sequential number corresponding to the written description, keying it on the drawing and providing a reference for job planning and future audits. Any inaccurate information on the component description should be noted and corrected in the information base. Conditions observed by inspectors that require testing or specialized inspection skills, such as removing material or inspecting hidden conditions, should be identified for follow-up work.

FIGURE 8

FACILITY AUDIT INSPECTION REPORT

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # _____ Name _____

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION _____

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures			
Def #	Description	Rating	Craft	Labor$ +	Mat'l$ =	Total Cost

After field work is completed, the inspection report form is prepared. Report preparation following field work enables the inspector to compare notes with other members of the audit team, request any specialized testing, and consult resources available for estimating costs of corrective measures.

PREPARING THE INSPECTION REPORT

The facilities condition inspection is based on building or infrastructure forms for recording field observations of deficiencies and corrective actions. All of the information gathered in field notes during an inspection is summarized on individual inspection forms. The inspection form is the basic information-collecting instrument. It is designed to generate data for a variety of summaries and is easily adapted to simple word processing or spreadsheet formats.

A sample of a completed inspection report is shown in Figure 9. The upper part of the form (Facility Inspection Data) identifies the facility, the component to be inspected, the inspector's name, and date of inspection. The middle part of the form (Component Description) provides a brief component description. The lower part of the form (Component Evaluation) numbers and describes each deficiency, assigns a priority rating, and indicates the corrective measures required to remedy the deficiency. A floor plan (Figure 10) shows the location of the deficiencies reported in the inspection form.

The entries on the sample inspection report form are obtained as follows:

1. FACILITY INSPECTION DATA

Facility # and Facility Name. This information is obtained from the Building File (Figure 6).

Component # and Component Name. This information is obtained from the outline of Building Component Descriptions (Figure 3).

Inspector Name and Date. Enter the full name of the inspector and the date of the inspection.

2. COMPONENT DESCRIPTION

The component is described using the component name entered in part 1 of the report form and made specific to include the component elements listed in Figure 3.

3. COMPONENT EVALUATION

Deficiency and corrective measures are reported in this section of the form. Data entries are as follows:

Deficiency #. A number is assigned in sequence for each deficiency. The number is used as a reference in deficiency summary reports and to identify the location of the deficiency on a floor plan or map.

FIGURE 9

PREPARING THE INSPECTION REPORT

FACILITY AUDIT INSPECTION REPORT

1. FACILITY INSPECTION DATA

Facility: # M-4 Name Laboratory Building

Component: # 5,6,7 Name Ceilings, Floors, Interior Walls & Partitions

Inspector Harry A. Morgan Date: 5/5/93

2. COMPONENT DESCRIPTION Suspended Ceiling Systems; Floor Finishes; Interior Walls & Partitions; Interior Doors & Frames; Hardware; Special Openings; Millwork

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures				
Def #	Description	Rating	Craft	Labor$	+ Mat'l$	=	Total Cost
1.	Moisture on interior wall surfaces * Check brick masonry separating from back-up walls	1	xx (structural inspection required)				
2.	Replace defective door closers @ 4 Stairways	1	CA	$400	+ $125	=	$525
3.	Repair masonry joints in mechanical room wall	2	MA	$300	+ $50	=	$350
4.	Remove & Replace stained ceiling tiles * Check roof for leaks	3	CA	$120	+ $100	=	$220
5.	Replace window seals on west wall	2	CA	$1,420	+ $1,800	=	$3,220
6.	Remove & replace worn corridor carpeting	3	XX	-	-		$2,400

Deficiency Description. Each deficiency is briefly described and a corrective repair or replacement action specified. Standard construction and maintenance terminology should be used. This is not a lengthy description of the problem; rather, it concentrates on the recommended corrective action.

Priority Rating. A priority rating system is based on the importance of taking the necessary corrective action. An important piece of information required for maintenance and capital renewal planning is when the repair should be accomplished, leading toward recommended funding requirements. Priority rating systems sort out relative importance of each action, such as enhancing life safety; preventing loss of a component, a system or an entire facility; meeting legal or code requirements; conserving energy or saving other costs. Low-priority projects are those that can be delayed for a time. A suggested priority outline is shown in Figure 11.

FIGURE 10

DEFICIENCY LOCATION

Facility: #4

Name: Laboratory Bldg.

Inspector: Harry Morgan

Date: 5/5/93

Component: 5,6,7

Location: 2d Floor

Component:

Ceilings; Floors; Interiors walls & Partitions

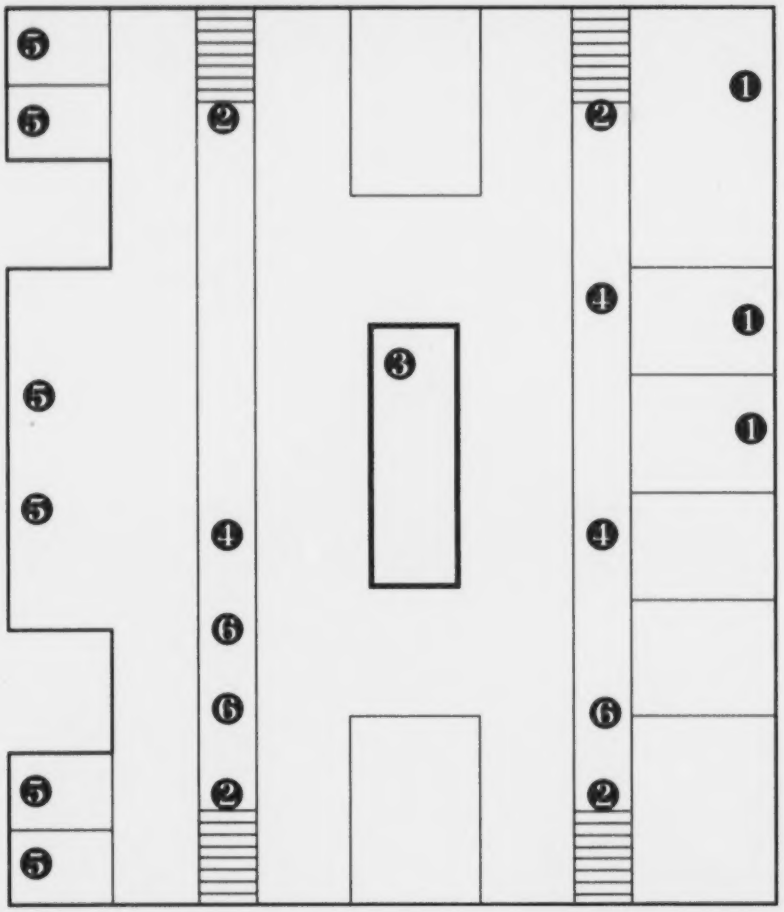


FIGURE 11

PRIORITY CRITERIA

PRIORITY 1

Urgent needs to be completed within one year, such as correcting a safety problem, eliminating damaging deteriorations, or complying with environmental or other codes.

PRIORITY 2

Potentially urgent deficiencies which, if not corrected within two years, will become urgent needs. Short-term, cost-payback projects to reduce operating costs can be included at this priority level or raised to the highest level, if funds are available.

PRIORITY 3 – 5

Deficiencies that are not potentially urgent but which, if deferred longer than three to five years, will affect the use of a facility or cause significant damage to it. Signs of deterioration in roofing are an example of this priority. Deficiencies identified in inspections that are aesthetic improvements, usually done on a routine schedule, should be inspected for problems to determine whether there is a need for a higher priority.

A "triage" approach should be followed in the inspection, sorting items for immediate action and implementation through a work order system from those that can be deferred. This approach builds the inspection concept into the regular daily work routine of supervisory and tradespeople and develops habits for recording and reporting building and infrastructure deficiencies. A useful checklist for flowing work into a work order system includes the following priorities:

1. life safety/property loss
2. code requirements
3. preventive maintenance (PM)
4. minor maintenance (upper cost limits set by the institution)
5. major maintenance (cost range defined by the institution)
6. capital renewal and/or replacement (projects defined by the institution)
7. appearance
8. Americans with Disabilities Act compliance

The recommended priority system in Figure 11 uses numbers representing a five-year planning cycle. Each year's inspection uncovers new deficiencies, and the priority listing is revised accordingly. Opportunities should be examined to group projects of different priorities to achieve economies of scale or use of similar trades and equipment. Buildings or infrastructure planned for renovation or major repairs should include all priorities. In such cases, lower priorities are not deferred to later years.

Craft. Craft classification for in-house work or a symbol for contractor work indicates who should do the work. Trade or shop classifications should be numbered in sequence or use recognizable two-digit symbols. For example, carpentry work can be identified as CA or by a two-digit code, such as 01. The decision to use contractors based on availability of in-house staff, staff capabilities to perform the work, or an established project cost limit and is identified by a letter or number code, e.g., RS or 90.

Estimated Cost. Costs of in-house work include labor, materials, and overhead. Schedules of trades staff hourly rates, including overhead, should be available when inspectors are transferring field notes to inspection reports. Material costs can be obtained from department, local vendors, or estimating sources such as *Means Estimating Cost Data* (R.S. Means Co., Inc.). Cost estimating information should be specific data for repairs and renovations, not new construction. Contractor estimates may be provided by in-house estimators or informational quotes from contractors. Contractor costs are entered as only total costs and should not include labor and materials. Including labor and materials may cause them to be erroneously budgeted as in-house costs. The total cost should be escalated for inflation when prioritized for future years, with the rate of inflation noted.

A sample worksheet for a major maintenance or capital renewal project request form is shown in Figure 12.

PREPARING THE FUNCTIONAL PERFORMANCE EVALUATION

A comprehensive audit includes an evaluation of building functional performance. Questions addressed in the functional performance evaluation are: How suitable is the building for its current use? How adaptable is it for alternative uses? What factors affect future uses? The purpose of providing this information is to guide prioritization of capital renewal/deferred maintenance projects with a background of long-term use considerations.

Responses to these questions are in narrative form, requiring a comprehensive knowledge of a building's present use, the total space inventory, and the overall institutional master plan. Functional performance evaluations are not normally done by maintenance staff. The facilities audit manager should refer these questions to the campus facilities planning officer or other knowledgeable staff.

Functional performance is reported on two forms, illustrated in figures 13 and 14. Together, these forms evaluate the suitability of a building for its present use and provide an invaluable reference for studies for future uses. The assignability of space is analyzed for future use, and various qualitative conditions such as traditional, historic, aesthetic, community, or other intangible values are taken into consideration.

FIGURE 12

SAMPLE WORKSHEET

MAJOR MAINTENANCE/CAPITAL PROJECT REQUEST

Location _____ FY _____

Facility Name/# _____

1. PROJECT TITLE

_____

2. PROJECT DESCRIPTION

_____

_____

_____

_____

3. PROJECT JUSTIFICATION

_____

_____

4. PROJECT COST ESTIMATE

Labor	$_____
Materials	$_____
Fees	$_____
Owner's Cost	$_____
Contingency	$_____
Total Cost	$_____

5. ANNUAL OPERATING COSTS

Maintenance	$_____
Utilities	$_____
Other	$_____

6. PROJECT SCHEDULE

Start Design Bid Construction Start Complete

_____

7. ESTIMATE PREPARED BY

_____ Date _____

FIGURE 13

FUNCTIONAL PERFORMANCE—SUITABILITY AND ADAPTABILITY

1. FACILITY INSPECTION DATA

Facility Name _____ Facility # _____

Inspector _____ Date _____

2. COMPONENT DESCRIPTION

a. Flexible Design Concept _____

_____

b. Partitions (Demountable or Rigid) _____

_____

c. Specialized Building Type _____

_____

d. Flexible Service Systems _____

_____

e. Stationary Equipment _____

_____

f. Functional Spaces _____

_____

g. Working Environment _____

_____

h. Circulation and Functional Relationships _____

_____

i. Conflicting Uses _____

_____

j. Code Conformance _____

_____

k. Disabled Accessibility _____

_____

l. Deferred Maintenance _____

_____

3. COMMENTS _____

_____

FIGURE 14

FUNCTIONAL PERFORMANCE—USE CONSIDERATIONS

1. FACILITY INSPECTION DATA

Facility Name _____ Facility # _____

Inspector _____ Date _____

2. COMPONENT DESCRIPTION

Traditional Values	Significant role or meaning relative to practices or values.
Historic Values	Significance to the institution or community for historic associations similar to National Register of Historic Places criteria.
Aesthetic Values	Visual qualities and physical relationships with other buildings or the landscape.
Social/Community Values	Benefits or detriments to location and/or community.
Interim Use	Other temporary uses of facility.
Future Land Use	Conflicting land use with future plans.
Suitability	Spatial characteristics relative to specific use or suitability specialized use difficult to replace.
Intangible Values	Orientation, psychological environment, noise, odors, etc.

3. COMMENTS _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Decisions on project priorities can be affected by information from the functional performance evaluation. A building that is inadequate to meet its current requirements or that has limited adaptability for future uses may have already been designated for renovation or replacement. In such a case, projects identified would be deferred until a final decision is reached on the building's future.

Evaluation of use considerations, providing comments on factors affecting a facility's potential, can identify critical issues for campus planning. The decision to replace or retain a structure will affect the location of future buildings. Functional performance is also useful in examining some of the negative aspects of facility suitability, such as conflicting land use, visual and physical arrangement problems, town-gown conflicts, and political or personal attitudes detrimental to the institution in future planning.

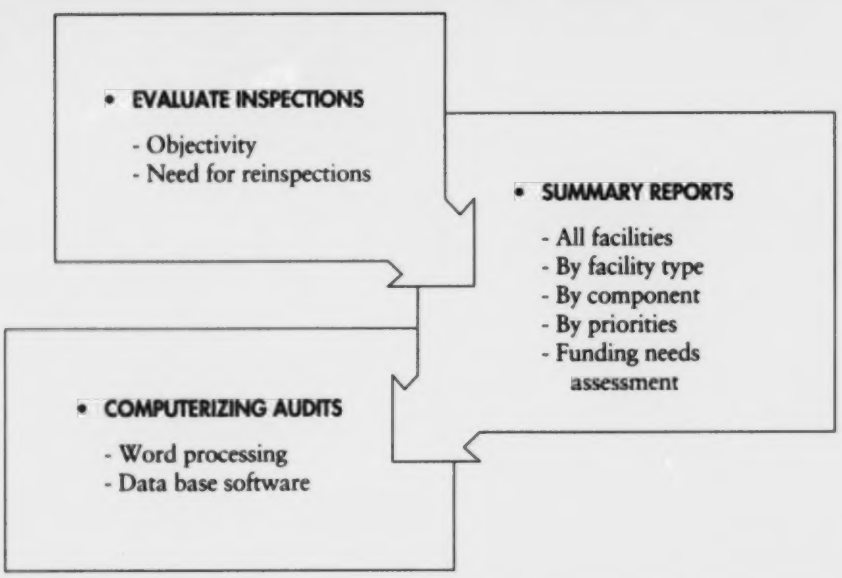
CHAPTER FIVE

• SUMMARIZING INSPECTION RESULTS

The third phase of the audit, summarizing results, reviews the data and the effectiveness of the inspections and develops summary reports of the inspection data. The items that make up this phase are listed in Figure 15. The audit manager reviews the completed inspection forms and plans or maps with indicated deficiencies and discusses the process with the inspectors. Results of any testing or laboratory work are evaluated to confirm the recommended corrective measures and accuracy of cost estimates.

FIGURE 15

PHASE THREE—SUMMARIZING RESULTS



EVALUATING THE INSPECTION PROGRAM

Thoroughness and consistency of the inspections are important considerations for the audit manager in reviewing inspection results. A random selection of inspections and visits by the manager can confirm results or suggest reinspections. Subjectivity of the inspectors is a factor that should be considered in evaluating recommended corrective measures. The manager should suggest any needed improvements in inspectors' training programs.

SUMMARY REPORTS

The information base developed by the inspection reports can be the source for a wide variety of summary reports. Using Building File data and inspection results, report formats offer information on the overall condition of facilities, facilities types, individual facilities, systems, or components. Further sorting of data can identify projects by priority, cost ranges, and use of in-house crafts or trades versus contractor work. Reports can be designed for presentations for different purposes and are limited only by needs determined by senior facilities and financial administrators.

Summary reports should be more than facts and figures. An executive summary should provide an overview and highlights of findings. A narrative should describe the audit process, objectives, and priority selection criteria. Conclusions should include a summary of overall facility conditions, a needs assessment for capital renewal/deferred maintenance projects, and an assessment of the adequacy of operating budgets for maintenance. Audit summaries can be organized in several ways: by all facilities audited or individual facilities; by all building systems or individual building systems; by all building components or individual building components. A suggested list of reports is shown in Figure 16.

Deferred maintenance problems can be the impetus for starting the facilities audit process. A thoroughly prepared and summarized audit will provide the basis for evaluating deferred maintenance and costs for remedying deteriorated conditions. Results provide the basis for a deferred maintenance reduction program.

Comments from the audit are also helpful in producing feasibility studies of changes in building use, resulting in renovations or replacements. The inspections and reports of building and infrastructure conditions and functional performance evaluation allow two critical questions to be addressed: 1) Is the facility suitable for its current use, or will it require remodeling? and 2) What is the actual cost of remodeling compared with a new building, and is relocation to another building feasible and desirable?

COMPUTER APPLICATIONS

An overall goal of facilities management is an information system that integrates maintenance work planning and major maintenance projects. Achieving this goal requires computer capabilities and programs purchased or designed for the task. The facilities audit process of inspecting

FIGURE 16

FACILITIES AUDIT SUMMARY REPORTS

A. ALL FACILITIES OR INFRASTRUCTURE

Report # 1 - Summary of all facilities or infrastructure deficiencies

Report # 2 - Summaries of all deficiencies by building or infrastructure type

Report # 3 - Summaries of all deficiencies by building or infrastructure age

Report # 4 - Summaries of all facilities or infrastructure deficiencies by systems

Report # 5 - Summaries of all facilities or infrastructure deficiencies by components

Report # 6 - Summaries of all facilities or infrastructure deficiencies by cost ranges

Report # 7 - Summaries of all facilities or infrastructure deficiencies by priorities

Report # 8 - Summaries of all facilities or infrastructure deficiencies by craft

B. INDIVIDUAL FACILITIES OR INFRASTRUCTURE

Report # 9 - Facility or infrastructure deficiencies

Report # 10 - Deficiencies by building or infrastructure type

Report # 11 - Deficiencies by building or infrastructure age

Report # 12 - Deficiencies by systems

Report # 13 - Deficiencies by components

Report # 14 - Deficiencies by cost ranges

Report # 15 - Deficiencies by priorities

Report # 16 - Deficiencies by craft

C. EXPENDITURE PLAN

Report # 17 - Capital renewal/deferred maintenance priorities

Report # 18 - Maintenance operating budget requirements

and reporting building and infrastructure conditions is one element of a desirable information system that supports work management and decision making on major maintenance priorities. Commercially available data base software can assist in sorting information, preparing reports, and extending the usefulness of an audit data base of facilities conditions.

The audit process and methodology are designed for manual use but are readily adaptable to computer applications. A starting point for basic computerizing of audits is word processing and spreadsheet software for generating forms for inspectors' use. Careful analysis of information desired from the audit is necessary before designing individual screens for each form and report. More sophisticated programs allow faster preparation of summaries where a computing capability is available to handle the data from a facilities audit. Finally, use of data base programs allows the integration of the audit into a facilities management information system.

Computerized applications of the facilities audit introduce a powerful tool for the facilities manager. Important benefits are readily retrievable information and capability for updating. Computerizing makes it easier to change the perspective of facilities management from collecting data for a one-time or occasional evaluation of conditions to updating facilities conditions on a continuing basis. Information becomes available immediately and a working style develops that instills the importance of continual inspections. Thus, the audit can become an operational tool, useful for predicting needs and a valuable component in decision making for maintenance management and prioritizing improvement projects.

FUTURE AUDITS

Although some information may be collected and analyzed by maintenance staff to ensure the working order of a facility, planning data needed to assess long-term needs are not typically included. The facilities audit process goes beyond maintenance planning. Following the audit procedures and using the suggested forms creates an information data base on facilities and infrastructure deficiencies that establishes a baseline for future condition surveys.

A data base also makes it easier to conduct special audits. For example, surveys of hazardous materials, conditions of components (e.g., roofs, roads), or building or space types (e.g., housing, classrooms) take less startup effort and will contribute to expanding a data base. The audit process provides a powerful tool for budget planning and allocation of resources and offers a method for regularly incorporating information obtained with a high level of confidence into facilities management decision making.

CHAPTER SIX

PRESENTING THE AUDIT FINDINGS

The final phase in the facilities audit process is presenting the findings and putting the audit to work. The steps that make up this phase are listed in Figure 17.

FIGURE 17

PRESENTING FINDINGS

- Communications
- Presentation Format
- Gaining Support

COMMUNICATING WITH THE AUDIENCE

The facilities audit is one of the most valuable tools available for facilities management in performing its responsibilities, if developed and presented well. But even a flawlessly performed audit is useless unless the information can be communicated to audiences in a readily understandable format. Careful consideration should be given to the audience, its interests, knowledge of the subject, and the issues it faces as a decision-making group. Conclusions and recommendations should stand on their own merits.

PRESENTATION FORMAT

The documentation provided by a facilities audit will be of more than passing interest because of its effect on campus financial conditions.

Thorough preparation is necessary in the design of materials and presentations to establish and maintain credibility for facilities management and the reliability of its information.

Before beginning the audit process, think about the presentation format. The wide array of summaries available from inspections should focus on priorities and costs, with supporting material keyed to condensed presentations. If the report of facilities conditions is to be submitted in

print form only without oral presentation, consider what graphic material would be helpful. The report itself may be presented as a brief statement of facts with graphics or in an extensive narrative that includes background, description of methodology, findings, and conclusions.

In all cases, the facilities administrator should provide material that is concise, easily understandable, and attractively presented. It should be free of jargon, confusing terms, or acronyms that are not self-explanatory. Do not oversimplify for readability, but do design the documents for easy cross-referencing.

Material should be developed in anticipation of the sharpest minds in the institution receiving the information. The documentation must be meticulous in detail and accuracy. Simple arithmetic errors and broad generalizations should be avoided through thorough checking of financial data, priority selections, and cost benefits. Expect the unexpected. Be prepared to answer the question: "What will happen if we postpone or don't do the work at all?" Organize the presentation so that the train of thought can be followed. Above all—keep the presentation simple and to the point.

SAMPLE PRESENTATIONS

Supporting material for a budget review session should be submitted in advance to all participants. The format for budget review sessions shown in Figure 18 should be used to ensure the clarity and conciseness of the presentation.

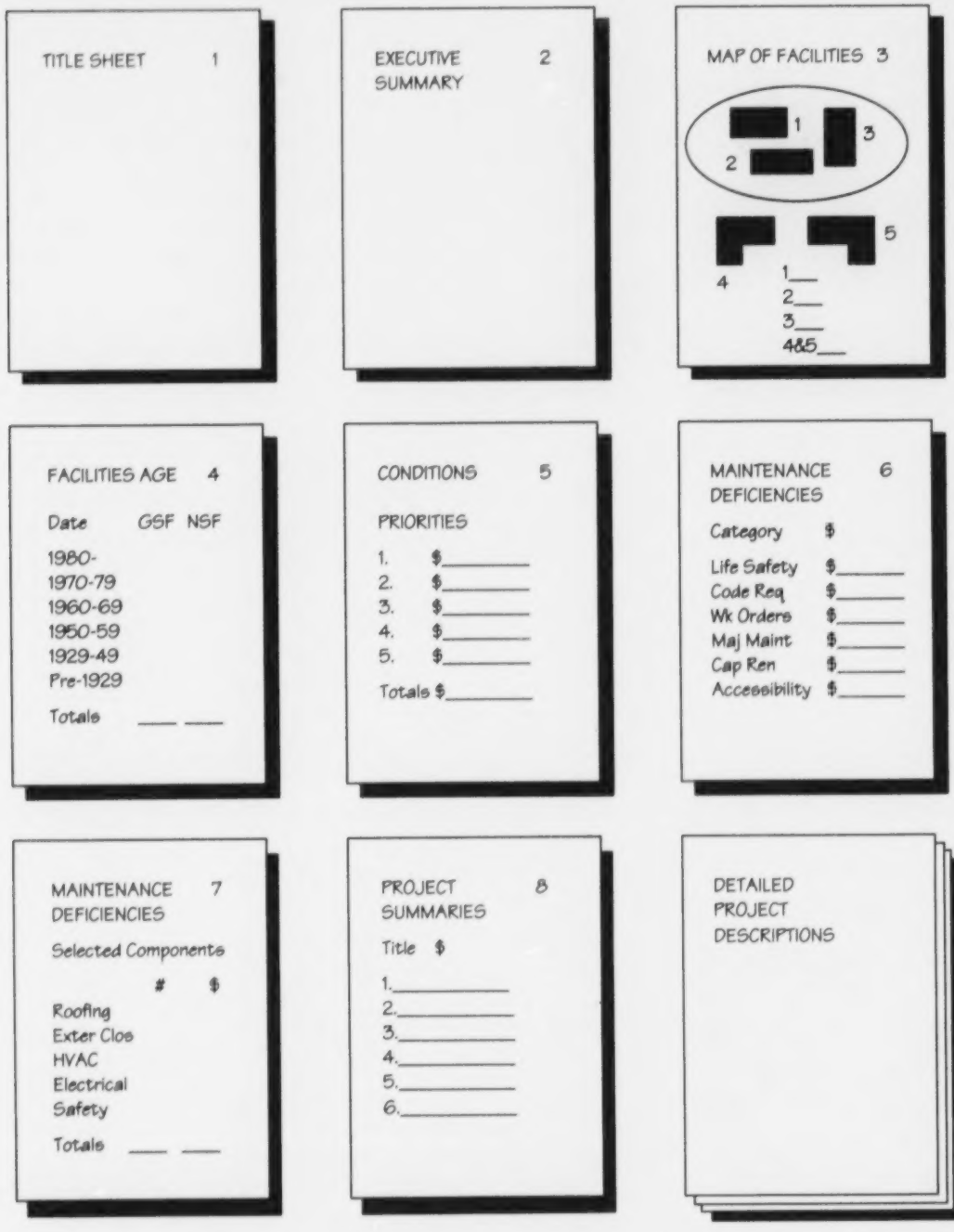
GAINING SUPPORT FOR THE FACILITIES AUDIT

Once the facilities audit is complete, how do you gain support for a program to correct deficiencies? Essentially, by developing an effective presentation—one that sells the conclusions and recommendations. Consider the following items when making any kind of audit presentation:

- **Overview.** Does the audit show a broad understanding of the budget mechanism and present a responsible fiscal position? Do the conclusions and recommendations fit into long-term policies and overall goals?
- **Credibility.** Does the audit show that previously allocated funds were well used? Does it take the initiative for making the best use of new resources for new programs?
- **Competency.** Did the audit team and implementing staff appear professional and competent during the audit process and in follow-up activities?
- **Thoroughness of Preparation.** Was the audit thoroughly researched and analyzed and professionally presented? Was there evidence of collaboration with budget managers and facility users in the preparation of the audit conclusions and recommendations? The form and content of the presentation must be an accurate presentation of the facts—objective, consistent, and capable of withstanding thorough scrutiny.

FIGURE 18

FACILITIES AUDIT PRESENTATIONS



- **Supportive Senior Administrator.** The budgetary allocation process represents competition for limited financial resources. Without a strong advocate, the facilities audit may be shelved. A senior administrator who understands the audit, conclusions, and recommendations is an invaluable ally in the funding and implementation process.
- **Preparation for Implementation.** The audit conclusions and recommendations must be in an immediately usable format for project planning and implementation. Administrators who will be involved in the implementation should be included in formulating of the conclusions. Operational staff should also be involved when possible. These contributions improve the end result and ensure that the purpose of the audit is clear to all parties.

CHAPTER SEVEN

CAPITAL RENEWAL: PUTTING THE AUDIT TO WORK

Polls of higher education CEOs have regularly shown deferred maintenance to be one of their top five priorities. But while their view of deferred maintenance has evolved from an alert to a call for action, some public systems and private campuses still are not fully addressing the problem. Many, however, have begun the difficult tasks of identifying needs, seeking funding, and reducing the backlog of work on decaying buildings and infrastructure.

Several states, including Arizona, Texas, and Virginia, have required comprehensive surveys of buildings and infrastructure conditions as a prerequisite for submitting annual or biennial capital funding requests. Campuses in some public systems must follow specific guidelines set forth in legislation or as school policy for collecting information on existing conditions, while many independent institutions have developed their own way to amass the data that reveal the deficiencies of decades of neglect. Facilities audit deficits in hundreds of millions of dollars are not uncommon; costs range from $15 to more than $40 per gross square foot of campus space, not including infrastructure repair costs.

A SHIFT IN FOCUS

Newsmagazine stories in the late 1970s heralded early alerts to the deferred maintenance problem. Graphic portrayals of scaffold-protected exterior walls, students huddled in overcoats in unheated classrooms, and laboratories with "closed for repair" signs drew awareness to the issue. Coincidentally, a national debate on the infrastructure crisis—illustrated by crumbling bridges, collapsing utilities, and disasters resulting in death—reiterated the problem within higher education facilities.

In the 1980s, campuses, propelled by a variety of initiatives by legislators, governing board members, campus presidents, business officers, and facilities managers, began surveying conditions. The publication of the original *Facilities Audit Workbook* (jointly published by APPA, AGB, and NACUBO in 1982) made available a tool for inspecting facilities condi-

tions. Its simple format, building on work done by the Tennessee Board of Higher Education and the military, provided a process that produced comparative ratings of campus facilities conditions. AGB's publication of *Crumbling Academe* (1984), APPA's *The Decaying American Campus* (1989), and NACUBO's *Managing the Facilities Portfolio* (1991) rounded out a decade of literature, which also included a profusion of association journal articles charting the way to proceed.

Results varied: some campuses responded with deferred maintenance reduction programs, others moved the problem onto priority agendas to seek funding, and still others struggled with overwhelming demands but failed to directly address the issue. Where there were successes, they can be attributed to a determination to break the cycle of facilities deterioration. Those institutional leaders who adopted sometimes unpopular programs of reallocating resources, found ways to develop multiple funding sources.

Perceptive facilities and financial managers understood that the term "deferred maintenance reduction" as a program description presented semantic barriers and created resistance. What followed was a subtle shift to a program of campus "capital asset renewal" to restore facilities to usable and attractive conditions vital to institutional stability. It is doubtful that a planned strategy to change terms from *deferred maintenance* to *capital renewal* occurred to inspired campus leaders. Imbued with the pessimism, frustration, and cynicism of business officers and facilities managers, deferred maintenance was a pejorative term. It implied failure in management, judgment, and stewardship, as though deferred maintenance was a result of inept management. Capital renewal offered a program consistent with institutional strategic planning.

As facilities and financial officers gained experience in addressing the problem of deteriorating campus facilities, they began to expand from a facilities to a financial lexicon. Concepts such as *facilities equilibrium* and *protection of capital assets* evolved into comprehensive strategies to deal with the overwhelming problems of renewing capital assets.

Building on a cornerstone of facilities audit information, the strategy alleviated the facilities managers' frustration with inaction by introducing a financial perspective. In some cases, governing boards allocated depreciation reserves to fund programs; others used reserves on hand or developed funding sources through gifts and grants. The cycle of facilities deterioration, altered by deferred maintenance backlog reduction programs, was also addressed by some systems and campuses by creating more intensive maintenance programs to avoid future risks to capital assets.

In the new strategy for dealing with facilities deterioration, the financial perspective defines protection of capital assets as a process of capital renewal of plant assets. "Immediate critical needs" are synonymous with

deferred maintenance. Long-term facilities renewal relates to concepts of depreciation; a capital reinvestment rate can be calculated to maintain the functional and financial value of facilities.

A complete capital renewal strategy includes:

- identifying conditions of capital assets (buildings, grounds, infrastructure, and equipment) and assessing findings
- prioritizing immediate critical needs
- developing multiple funding sources for continuous attention to capital renewal
- adjusting campus capital expenditure priorities from new construction to capital asset renewal
- establishing new maintenance programs designed to prevent accumulation of capital asset deterioration

PUTTING THE AUDIT TO WORK

Putting the audit to work means developing an ethic among maintenance staff to continually inspect facilities, observe and report deficiencies, and maintain a timely and accurate record of facilities conditions. It also means developing funding alternatives, and procedures for managing funding, and assuring that current use of resources is effective and efficient.

Planning programs for capital renewal and deferred maintenance reduction requires estimating funding needs and the difficult task of assigning priorities. Presentation of audit findings should be accompanied by a facilities needs assessment describing a funding plan for capital allocation priorities and an adequate maintenance operating budget. Programs will require components for "catch-up" costs and "steady-state" costs. The program should be realistic in terms of the ability to absorb funding, with time allocated to preparing contract documents and managing projects.

The facilities audit process provides the basis for determining capital needs to avoid future facilities deterioration. This process enables you to assess your short- and long-term needs for dealing with the problem. The audit process also supports the comparative assessment of facilities conditions and development of priorities. Too often, at this point, the process ends in frustration because of the governing board's lack of response to funding requests. Many systems and institutions lack three important components: 1) a project prioritization process; 2) a resource allocation model to formulate funding planning; and 3) a will to change the campus culture in favor of capital asset renewal. Although the number of successful examples is increasing, the evidence of national surveys shows that the rate of facilities deterioration also continues to increase. Despite a weak national economy and financial distress in higher education, the problem must be faced sooner than later.

CAPITAL RENEWAL PLANNING

Capital renewal planning is a continuous process, beginning with a preliminary plan and evolving into a final plan adjusted on an annual basis. A preliminary plan for capital renewal resource allocation should define the overall goals for both short-term needs for deferred maintenance and long-term needs for life-cycle renewal of facilities components. Such a plan for guiding the shift in the level of facilities conditions from marginal to desirable will be influenced by each institution's mission and strategic plan. These factors have become increasingly important as declining resources have affected restructuring, resulting in downsizing/rightsizing, shifts in emphasis from research to undergraduate teaching, and demands to improve the quality of campus residential life. Thus, a resource allocation model for capital renewal is an integral part of an overall strategic plan.

The process of developing a preliminary plan includes:

- project prioritization
- rate of annual capital reinvestment
- duration of a deferred maintenance reduction program

A final capital renewal plan evolves from fitting a funding model to a selected rate of capital reinvestment that balances a desired amount of expenditures over a period of time with the duration of reducing deferred maintenance backlog. The result is a coordinated program for capital renewal and maintenance that is designed to protect capital assets, a funding plan, and a method for monitoring the program.

PROJECT PRIORITIZATION

Prioritizing capital renewal projects is an objective process for allocating limited resources. The priority criteria used for the inspection worksheets described in Figure 11 on page 28 provide a ranking that can be reviewed for budgeting decisions on a year-to-year basis. Criteria related to your campus's goals and objectives are valuable as a standard for annual review as priorities and resources change.

RESOURCE ALLOCATION

How much to spend on capital renewal is guided by the results of an audit and the total cost of prioritized projects. Questions to be posed for resource allocation are: 1) What are the effects of different amounts of annual expenditures for capital reinvestment on total backlog reduction?; and 2) What is a desirable rate of annual expenditures for reducing marginal facilities conditions?

Restated, this could be posed as: How will *X* dollars for some years reduce a backlog of deficiencies at the end of the period? Or: How much must be spent to reach a desired level of conditions for all campus facilities over a certain number of years? Key variables are the capital reinvestment rate and the backlog targets. Factored into decisions in both cases are the inflation rate, the rate of plant deterioration, and the backlog deterioration rate.

The facility conditions index (FCI), a method of comparing facilities conditions based on a ratio of facilities deficiencies to current replacement value (CRV), is useful in setting annual funding targets and the duration of deferred maintenance reduction. The FCI method was developed by Applied Management Engineering of Virginia Beach, Virginia, and was published in 1991 by NACUBO in *Managing the Facilities Portfolio.*

$$\text{Facility Condition Index (FCI)} = \frac{\text{deficiencies}}{\text{current replacement value}}$$

The FCI uses empirical data to benchmark relative measures of conditions on campuses:

FCI < 5% (.05) = Good condition
FCI 5-10% (.05-.10) = Fair condition
FCI > 10% (.10) = Poor condition

For example, after conducting an inspection of buildings and infrastructure, a campus with 3.5 million GSF finds it has $60 million in deferred maintenance. At an average CRV of $100/GSF ($350 million), the FCI is .171, an indication of poor conditions.

The audit's information on deficiencies provides the basis for estimating short- and long-term capital needs, in terms of a deferred maintenance reduction program and a component renewal program. Component renewal, based on life cycle of components, is necessary to prevent future deferred maintenance backlogs.

Costs for correcting facilities deficiencies obtained from an audit and a calculation of the CRV allow you to model the variables for annual and total funding needs and the rate of backlog reduction. For example, if only 1 percent of the CRV is available, the change in the FCI can be calculated. Or, a determination to achieve an FCI of 5 percent in ten years can produce a calculation of annual capital renewal needs.

A rule of thumb for the annual reinvestment rate is 1.5 to 3 percent of CRV. However, experience is showing a preference for the upper end of the range (2.5 to 3 percent) to prevent further accumulation of a deferred maintenance backlog. This is separate from funding required to eliminate immediate critical needs of deferred maintenance. A capital renewal plan must include funding for deferred maintenance backlog reduction and for component renewal. This concept is fundamental to capital renewal funding planning.

FUNDING/PLANNING

Seeking funds for capital renewal on the scale required to reduce deferred maintenance backlogs is a challenging venture for higher education. The traditional method of funding capital improvements—sources such as gifts and grants—is inadequate for the task faced by many campuses. Successful examples show that multiple funding sources are necessary to provide a stream of funding that meets capital and component renewal project priorities. Spacing out projects over a period of time allows you to pool

multiple sources to meet annual needs. This principle enables you to fund planning that can incorporate some of the following experiences of public systems and independent institutions.

Bond Issues. Borrowing for capital projects is a routine practice for public systems of higher education and used occasionally by independent institutions. The urgent need for capital renewal has made acceptable the issuing of general obligation bonds, revenue bonds, or other options for new construction, for reinvesting in existing facilities. The Commonwealth of Virginia and the states of California, Georgia, and Mississippi, among others, have recently initiated this practice. Vanderbilt University borrowed $150 million to finance renovation and deferred maintenance projects.

Operating Budgets. Some institutions have begun supplementing annual operating budgets with additional funds for capital renewal. Even in difficult financial times, states and independent institutions have both begun to reallocate financial priorities by establishing an amount in the operating budget specifically for deferred maintenance.

The College of Wooster initiated a funding model in 1977 using a "capital charge" budgeting concept to develop a reliable source of capital renewal funding for five-year planning cycles. An amount incorporated annually into the operating budget was defined as a charge to create a reserve for funding capital renewal and debt reduction. An unrestricted gift was allocated to a reserve fund to initiate the concept. Each year's charge to the annual operating budget is an average of projects budgeted in the current year and estimates of projects to be done in each of the next four years. The pool of reserve funds is drawn down as required by priority projects.

The Commonwealth of Virginia developed a maintenance reserve appropriation in 1982, distributing funds to public institutions using a formula developed by Douglas R. Sherman and William A. Dergis ("A Funding Model for Building Renewal," 1981). Each institution is required to prepare a maintenance reserve plan describing projects. Funding is a supplement to the operating budget for maintenance, following an assumption that approximately 50 percent of the formula amount is already contained in the operating budget.

Depreciation Accounting. The introduction of depreciation accounting to higher education in 1990 offers a potential solution to provide a constant funding source for capital renewal. Although not sufficient to fund substantial backlogs of deferred maintenance, maintenance depreciation reserves can provide a substantial source for renewal funding. The challenge is to create depreciation reserves from current revenues equal to the declining value of capital assets. Some institutions that were able to use "off-balance" sheet funding for capital renewal are now creating depreciation maintenance reserve funds from revenues and including them in operating budgets.

The model created by Boston College in 1976 combined the annual operating budget and a separate capital budget for renewal funding. Boston College was able to rely on unexpended depreciation reserves for capital budgeting. Depreciation accounting and funding the depreciation charge through its operating budget was an innovative technique. Based on the concept that current users should pay for renewal and replacement, an equitable charge was included in the annual operating budget to develop a consistent source for funding facility renewal. The retirement of long-term debt and a reduction in acquiring debt for new projects will improve the allocation of available funds for future renewal.

Quasi-Endowment Funds Conversion. Institutions with quasi-endowment funds or "funds functioning as endowment" have sacrificed interest earnings by designating the funds for use in capital renewal. This is a controversial action requiring approval by a governing board, but it is a valid stopgap when current revenues are unavailable and the institution wishes to avoid incurring additional debt. Rensselaer Polytechnic Institute plans to partially fund $142 million in deferred maintenance by converting unrestricted quasi-endowment funds.

Plant Fund Reserves. Building up plant fund reserves by transfering income surpluses offers another source for capital renewal funding. This decision is made in assigning priorities in the institutional budget-making process. Although not a guaranteed stream of funding, prudent financial management can create reserves allocated to fund deferred maintenance projects. Reserves can be drawn from a pool of funds as projects are defined and expenses incurred. Syracuse University used plant fund reserves to supplement maintenance operating budgets for funding over $150 million in capital renewal and replacement over a fifteen-year period, beginning in 1973.

Fund Raising. Obtaining gifts for capital renewal presents a greater challenge than funding new construction. New or expanding programs or replacement of existing facilities have a greater appeal to donors than requests to fund deferred maintenance. However, as decaying campus facilities have become a high priority, attention has shifted from new projects to the renovation of existing facilities as a target for designated gifts.

Strategies have varied, from individual campaigns for specific facilities to an overall fund raising effort with unrestricted gifts channelled to capital renewal. These approaches afford alternatives for development programs and donor choices. Some campuses have prepared lists of capital renewal projects to be included in major fund raising programs. Changes in policies of foundations have seen the new priorities as valid reasons to award grants in support of renovation projects. By pooling challenge grants with gifts and other institutional resources, campuses can achieve a goal for a designated project not easily reached with a single gift.

Energy Conservation. Deferred maintenance projects for mechanical and electrical systems, utilities infrastructure, or central energy plants can be treated as unique capital renewal projects for energy conservation. Facilities audits have shown that 40 to 50 percent of deferred maintenance

exists in these categories. The rationale that energy conservation will result from these projects is based on cost-benefit analyses identifying payback periods. Thus, an investment in energy conservation can be considered self-financing.

Vanderbilt University finances energy conservation through a utility depreciation reserve created by a 14 percent "tax" added to the university's electric bills. The reserve has been supplemented by energy conservation grants. Syracuse University has obtained over $6 million in energy conservation grants, some at 100 percent of project costs and others as matching grants. Sources include federal and state programs, and programs offered by the local public utility to stimulate demand-side energy reductions. Incentives offered by private companies to participate in energy savings are an alternative method of funding a component of deferred maintenance.

THE MANAGEMENT RENEWAL CHALLENGE

The facilities officer should not be discouraged at the initial response to the magnitude of costs reported in a comprehensive audit for capital renewal/deferred maintenance reduction and the gap between current and required funding to maintain renewed facilities. Resource reallocation and supplementary funding will probably be required for renewal and replacement of facilities with a high proportion of deficiencies. Capital renewal is a long-term process and programs should be designed with this in mind. The audit process is a key component of a capital renewal program that should be updated annually, reporting progress toward goals, identifying new priorities, and adjusting to programmatic changes affecting renewal and replacement.

A useful approach to consider is the revitalization of facilities staff to inspire confidence for funding deferred maintenance. Feelings of pessimism, frustration, and cynicism among the facilities staff at Santa Clara University stimulated a program of facilities management renewal to cope with lack of support for deferred maintenance funding. The concept centered on the renewal of the management team, changing attitudes to gain credibility for funding deferred maintenance. Santa Clara's facilities management adopted a vision for their capital renewal program that included:

- communicating, with credibility, the scope of the renewal and deferred maintenance needs and costs
- proposing a strategy for achieving facilities equilibrium in a reasonable time frame
- engaging in the budget decision process to ensure understanding of and advocacy for renewal projects
- achieving measurable results, small and large, short-term and long-term

Facilities management team renewal can strengthen support for funding facilities renewal by increasing management's credibility through improved attitudes, actions, and accomplishments. The attitudes, visions, and strategies of Santa Clara University's management team are applicable to facilities managers throughout higher education.

CONCLUSION

The facilities audit process described in this book presents the experiences of facilities administrators at public and private higher education systems and campuses, government and corporate employees, and many consultants. These methods evolved over a period of time to meet the needs of administrators and plant operations staff for assessing facilities conditions and presenting funding requirements in different places around the world. Procedures for the deficiency-cost audit method were especially designed for flexibility in manual use or adaptability in computerized applications. Applying the facilities audit process to your organization will both enhance present and future functional use and benefit members of the campus community.

APPENDIX A

SAMPLE INSPECTION FORMS AND CHECKLISTS

A. FACILITY INVENTORY

A.1. Building Inventory List
A.2. Building File
Standard Inspection Form

B. BUILDING COMPONENTS

Primary Systems

B.1. Foundation and Substructure
B.2. Structural System
B.3. Exterior Wall System
B.4. Roof System

Secondary Systems

B.5. Ceiling Systems
B.6. Floor Covering Systems
B.7. Interior Wall and Partition Systems
B.8. Specialties

Service Systems

B.9. Heating, Ventilating, and Cooling
B.10. Plumbing Systems
B.11. Electrical Service
B.12. Electrical Lighting
B.13. Conveying Systems
B.14. Other Systems

Safety Standards

B.15. Safety Standards

C. INFRASTRUCTURE COMPONENTS

C.1. Site Work
C.2. Landscaping
C.3. Structures
C.4. Utilities

D. FUNCTIONAL PERFORMANCE

D.1. Suitability and Adaptability
D.2. Use Considerations

A.1. BUILDING INVENTORY LIST

BUILDING INVENTORY LIST	BUILDING #	BUILDING NAME	BUILDING LOCATION/ ADDRESS	OWNERSHIP O/L/O-L

A.2. BUILDING FILE

BUILDING DATA

1. Building # _____ 2. Building Name _____
3. Address _____
4. Grid Location _____ 5. Use _____
6. # Floors _____ 7. Gross Area (sq. ft.) _____
8. Net Assignable Area (sq. ft.) _____
9. Ownership ___ (O) ___ (L) ___ (O/L)
10. Book Value $_____ 11. Replacement Value $ _____
12. Age (Original construction, additions) _____

LAND DATA

1. Location _____
2. Ownership ___ (O) ___ (L) ___ (O/L)
3. Book Value $_____ 4. Current Market Value $ _____
5. Year(s) Acquired_____ 6. Area (acreage, sq. ft.) _____

NOTES: _____

STANDARD INSPECTION FORM

FACILITY AUDIT INSPECTION REPORT

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # _____ Name _____

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION _____

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures				
Def #	Description	Rating	Craft	Labor$ +	Mat'l$ =	Total Cost

B.1. FOUNDATION AND SUBSTRUCTURE CHECKLIST

Components: Footings; Grade beams; Foundation walls; Waterproofing and underdrain; Insulation; and Slab-on-grade.

DEFICIENCIES	CAUSES
Settlement, alignment changes or cracks	• Soils— changes in load bearing capacity due to shrinkage, erosion, or compaction. Adjacent construction undermining foundations. Reduced soil cover resulting in frost exposure. • Design loads— building equipment loads exceeding design loads. Vibration from heavy equipment requiring isolated foundations. • Structural or occupancy changes— inadequate bearing capacities. Foundation settling. Earthquake resistance non— functioning.
Moisture penetration	• Water table changes— inadequate drainage. Ineffective drains or sump pump/sump pits. • Roof drainage— storm sewer connections inadequate or defective. Installation of roof restrictors, gutters, and downspouts where required. • Surface drainage— exterior grades should slope away from building and structures. • Utilities— broken or improperly functioning utility service lines or drains. • Leakage— wall cracks, opening of construction joints, inadequate or defective waterproofing. • Condensation— inadequate ventilation, vapor barrier, and/or dehumidification.
Temperature changes	• Insulation— improperly selected for insulating value, fire ratings, and vermin resistance.
Surface material deterioration	• Concrete, masonry, or stucco— spalling, corrosion of reinforcing, moisture penetration, or chemical reaction between cement and soil. • Steel or other ferrous metals— corrosion due to moisture or contact with acid-bearing soils. • Wood— decay due to moisture or insect infestation.
Openings deterioration	• Non-functioning of doors, windows, hatchways, and stairways. Utilities penetration due to damage, weather, wear, or other cause.
Floors, concrete — cracking or arching	• Shrinkage, settlement, or subsoil, inadequate drainage, movement in exterior walls, or frost heave. Improper compaction of base. Heaving from hydraulic pressure.
Floors, wood — rooting or arching	• Excessive dampness or insect infestation. Leak in building exterior. Lack of ventilation.
Crawl space ventilation and maintenance	• Inadequate air circulation due to blockage of openings in foundation walls. Moisture barrier ineffective. Pest control, housekeeping, and proper drainage.

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.1 Name Foundation and Substructure

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION

Footings; Grade beams; Foundation walls; Waterproofing and under drain; Insulation and Slab-on-grade

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures			
Def #	Description	Rating	Craft	Labor$ + Mat'l$	= Total Cost	

B. 2. STRUCTURAL SYSTEM CHECKLIST

Components: Floor system; Roof system; Structural framing system; Pre-engineered buildings; Platforms and walkways; and Stairs.

The primary materials encountered in the superstructure inspection are concrete, steel, and wood. Typical observations of deficiencies will be observed by: failures in the exterior closure system of exterior walls, openings, and roofs; cracks; movement of materials; moisture penetration; and discoloration. The exterior visual survey will detect failures of surface materials or at openings that will require further inspection to determine whether the cause was the structural design.

Concrete is a composite material and subject to more types of failure than steel or wood. Observed failures can originate by incorrect design and construction techniques not readily detected by visual inspections. Analysis of original design criteria and materials by laboratory testing may be required to determine the causes of problems.

DEFICIENCIES	CAUSES
Concrete (Columns, walls, beams, and floor and roof slabs)	
Overall alignment	• Settlement; improper or inadequate design and construction techniques. Under designed for loading conditions.
Deflection	• Expansion and/or contraction; changes in design loads. Original design deficient. Original materials deficient.
Surface conditions:	
Cracks	• Inadequate design and/or construction; changes in design loads; stress concentration; extreme temperature changes; secondary effects of freeze-thaw.
Scaling, spalls, and pop-outs	• Extreme temperature changes; reinforcement corrosion; mechanical damage; poor materials.
Stains	• Chemical reaction of reinforcing; reaction of materials in concrete mixture; environmental conditions.
Exposed reinforcing	• Corrosion of steel; insufficient cover; mechanical damage.
Steel (Structural members, stairs, and connections)	
Overall alignment	• Settlement; design and construction techniques; improper fabrication.
Deflection or cracking	• Expansion and/or contraction; changes in design loads; fatigue due to vibration or impact.
Corrosion	• Electrochemical reaction; failure of protective coating; excessive moisture exposure.
Surface deterioration	• Excessive wear
Wood (Structural members and connections)	
Overall alignment	• Settlement; improper or inadequate design and construction techniques.
Deflection or cracking	• Expansion and/or contraction; changes in design loads; fatigue due to vibration or impact; failure of compression members. Poor construction techniques. General material failures.
Rot (Decay)	• Direct contact with moisture; condensation; omission or deterioration of moisture barrier. Poor construction techniques. Damage from rodents or insects.

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.2 Name Structural System

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Floor system; Roof system; Structural framing system; Pre-engineered buildings; Platforms and walkways; Stairs

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

B.3. EXTERIOR WALL SYSTEM CHECKLIST

Components: Exterior walls; Exterior windows; Exterior doors and frames; Entrances; Chimneys and exhaust stacks.

GENERAL INSPECTIONS

Overall appearance	Window & door fit	Settlement
Displacement	Flashing condition	Evidence of moisture
Paint conditions	Material integrity	Construction joints
Caulking	Cracks	Hardware conditions

EXTERIOR WALLS

- **Wood** (Shingles, weatherboard siding, plywood)

	Check for:
Paint or surface treatment conditions	Moisture penetration
Rot or decay	Loose, cracked, warped, or broken boards and shingles

- **Concrete, Masonry, and Tile** (Concrete, brick, concrete masonry units, structural tile, glazed tile, stucco, stone)

	Check for:
Settlement	Structural frame movement causing cracks
Construction and expansion joints	Condition of caulking and mortar
Surface deterioration	Efflorescence and staining
Parapet movement	Tightness of fasteners

- **Metal** (Corrugated iron or steel, aluminum, enamel coated steel, protected metals)

	Check for:
Settlement	Structural frame movement
Condition of bracing	Surface damage due to impact
Tightness of fasteners	Caulking
Flashings	Corrosion

- **Finishes** (Mineral products, fiberglass, polyester resins, and plastics)

	Check for:
Settlement	Structural frame movement
Surface damage due to impact	Cracks
Stains	Fasteners
Adhesion to substrate	Caulking
Flashings	

B. 3, *continued*

EXTERIOR WINDOWS AND DOORS

Check for:

Frame fitting
Paint or surface finish
Cleanliness
Rot or corrosion
Frame and molding condition
Putty and weatherstripping
Security
Material condition (glass, wood, and metal panels)
Screens and storm windows

SHADING DEVICES

Check for:

Material condition
Cleanliness
Operations

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.3 Name Exterior Wall System

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Exterior walls; Exterior windows; Exterior doors and frames; Entrances; Chimneys and stacks

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def#	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

B.4. ROOF SYSTEM CHECKLIST

Components: Roofing; Insulation; Flashings, expansion joints, and gravel stops; Roof hatches, smoke hatches, and skylights; Gutters and downspouts; Walking surfaces; Railings.

Note comments on following:

GENERAL APPEARANCE

___Good ___Fair ___Poor

WATERTIGHTNESS

___Evidence of leaks on undersurface
___Faulty material
___Faulty application
___Weather damage
___Fastening failure
___Surface weathering
___Faulty design
___Standing water
___Mechanical damage
___Flashing failure

ROOFING SURFACES

Built-up *(Felt or bitumen surfacing)*
___Adhesion
___Bare areas
___Cracks, holes, tears
___Alligatoring
___Moisture meter readings
___Blisters, wrinkles
___Fish mouths
___Ballast

Single-ply *(Thermosetting, thermoplastic, composites)*
___Adhesion
___Bare areas
___Cracks
___Seam conditions
___Ballast
___Moisture meter readings
___Blisters, wrinkles
___Holes, tears
___Protective coating

Metal Roofing *(Preformed, formed)*
___Corrosion (%)
___Seams
___Holes
___Protective coating
___Cracks or breaks
___Expansion joints

Shingles & Tiles *(Metals, clay, mission, concrete, or others)*
___Disintegration
___Missing (%)
___Underlayment
___Broken or cracked (%)
___Fasteners

Wood Shingles
___Cracked
___Curled
___Missing (%)

INSULATION *(Rigid, spray-on, sheets)*

___Disintegration
___Moisture

B.4, *continued*

FLASHINGS, EXPANSION JOINTS & GRAVEL STOPS

___Deterioration
___Holes or damage
___Protective coating

ROOF HATCHES, SMOKE HATCHES & SKYLIGHTS

___Flashings, seals
___Glazing , covering

DRAINAGE, GUTTERS & DOWNSPOUTS

___Alignment, pitch
___Clamping rings secure
___Corrosion

WALKING SURFACES

___Surface condition
___Fasteners
___Drainage

RAILINGS

___Attachments
___Structural condition
___Finishes
___Code compliance

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.4 Name Roof System

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Roofing; Insulation; Flashings, expansion joints, and gravel stops; Roof hatches, smoke hatches, and skylights; Gutters and downspouts; Walking surfaces; Railings

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures			
Def #	Description	Rating	Craft	Labor$	+ Mat'l$	= Total Cost

B.5. CEILING SYSTEMS CHECKLIST

Components: Exposed structural systems; Directly applied; Suspended systems.

GENERAL INSPECTION

Note comments on following:

Building user comments _____

_____

Overall appearance:

___Good ___Fair ___Poor

___Settlement or sagging
___Alignment
___Attachment
___Evidence of moisture
___Stains, discoloration
___Missing units
___Suitability
___Acoustic quality
___Code compliance

EXPOSED STRUCTURAL SYSTEMS (UNPAINTED, PAINTED, SPRAY-ON, DECORATIVE)

___Cracks
___Surface deterioration
___Missing elements
___Adhesion

DIRECTLY APPLIED & SUSPENDED SYSTEMS

Overall appearance:

___Good ___Fair ___Poor

___Fasteners
___Trim condition

Openings:

___Panels
___Inserts
___Lighting fixtures
___Air distribution
___Fire protection
___Other

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.5 Name Ceiling Systems

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Exposed structural systems; Directly applied; Suspended systems

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

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B.6. FLOOR COVERING SYSTEMS CHECKLIST

Components: Carpet; Composition; Concrete; Resilient; Ceramic tile; Masonry; Terrazzo; Wood; Metal; Other (raised floors, etc.).

GENERAL INSPECTION

Note comments on following:

Building user comments _____

_____

Overall appearance:

___Good ___Fair ___Poor

___Evidence of moisture
___Visible settlement
___Irregular surface
___Tripping hazards
___Accessibility hazards

Replacement necessary _____

CARPET

(Tufted, tile)

___Age
___Wear
___Stains
___Discoloration
___Holes, tears
___Seam conditions

RESILIENT

(Asphalt tile, cork tile, linoleum, rubber, vinyl)

___Broken tiles
___Loose tiles
___Shrinkage
___Lifting, cupping
___Fading
___Cuts, holes
___Porosity

MASONRY

(Stone, brick)

___Cracks
___Deterioration
___Joints
___Stains
___Porosity
___Sealing

MONOLITHIC TOPPING

(Concrete, granolithic, terrazzo, magnesite)

___Cracks
___Porosity
___Joints
___Sealing

WOOD

(Plank, strips, block, parquet)

___Shrinkage
___Cupping, warpage
___Excessive wear
___Uneveness
___Decay
___Sealing

OTHER

(Raised floors, etc.)

_____
_____
_____
_____

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FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.6 Name Floor Covering Systems

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Carpet; Composition; Concrete; Resilient; Ceramic tile; Masonry Terrazzo; Wood; Metal; Other (raised floors, etc.)

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

B.7. INTERIOR WALL & PARTITION SYSTEMS CHECKLIST

Components: Interior walls; Wall coverings and finishes; Interior doors, windows, and frames; Hardware; Special openings (access panels, shutters, etc.).

PARTITIONS, FRAMING & MOVABLE WALLS

___Strength and stability
___Physical condition
___Acoustic quality
___Evidence of moisture
___Maintainability
___Adaptability
___Code compliance
___Abuse, vandalism

WALL COVERINGS & FINISHES

___Cracks
___Joint openings
___Peeling, flaking
___Rips, tears
___Looseness
___Water stains, discoloration
___Missing segments

INTERIOR DOORS, WINDOWS & FRAMES

___Frame conditions
___Frame anchoring
___Door surfaces
___Glazing
___Seals
___Shading devices

HARDWARE

___Overall condition
___Maintainability
___Appearance
___Operation
___Keying system
___Fit
___Locksets
___Closure devices
___Panic devices
___Security operations

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.7 Name Interior wall & Partition System

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Interior walls; Wall coverings and finishes; Interior doors, windows, and frames; Hardware; Special openings (access panels, shutters, etc.)

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

B.8. SPECIALTIES CHECKLIST

Components: Bathroom accessories; Kitchen equipment; Laboratory equipment; Projection screens; Signage; Telephone enclosures; Waste handling; Window coverings, etc.

GENERAL INSPECTION

Note comments on following:

Building user comments _____

_____

Overall appearance:

___Good ___Fair ___Poor

___Suitability
___Attachment
___Missing components
___Operating condition

___Vandalism
___Repairs/replacements
___Code compliance

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.8 Name Specialties

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION

Bathroom accessories; Kitchen equipment; Laboratory equipment; Projection screens; Signage; Telephone enclosures; Waste handling; Window coverings, etc.

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

B.9. HEATING, VENTILATING & COOLING CHECKLIST

Components: Boilers; Radiation; Solar heating; Ductwork and piping; Fans; Heat pump; Fan coil units; Air handling units; Packaged rooftop A/C; Packaged water chillers; Cooling tower; Computer room cooling.

GENERAL INSPECTION:

Building user comments _____

Lubrication: bearings and moving parts _____

Rust and corrosion _____

Motors, fans, drive assemblies _____

Wiring and electrical controls _____

Thermostats and automatic temperature controls _____

Thermal insulation and protective coatings _____

Guards, casings, hangers, supports, platforms, and mounting bolts _____

_____

Piping and piping system identification _____

Solenoid valves _____

Burner system assemblies _____

Combustion chambers, smoke pipes _____

Electrical heating units _____

Guards, casings, hangers, supports, platforms, and mounting bolts _____

_____

Steam and hot water heating equipment _____

Accessible steam, water, and fuel piping _____

Traps _____

Humidifier assemblies _____

Water sprays, weirs, and similar devices _____

Shell-and-tube type condensers _____

Self-contained evaporative condensers _____

Air-cooled condensers _____

Compressors _____

Liquid receivers _____

Refrigerant driers, strainers, valves, oil traps, and accessories _____

_____

B.9, *continued*

Cleaning, maintenance, repair, and replacement:

___Registers
___Grills
___Dampers
___Louvers
___Bird and insect screens
___Supply and return ducts
___Drain pans
___Coils

Air Filters:

___Type
___Replacement schedule

SYSTEM EVALUATION

___Heating capacity
___Temperature control

Heating:

___Seasonal
___All year
___Noise level
___Energy consumption
___Air circulation and ventilation
___Filtration
___Humidity control

Cooling:

___Seasonal
___All year
___Cooling capacity
___Temperature and humidity control
___Noise level
___Energy consumption
___Air circulation & ventilation
___Filtration
___Reliability

Ventilation:

___Air velocity
___Exhaust air systems
___Bag collection
___Wet collectors
___Steam and hot water coils
___Electrical heating units
___Fire hazards
___Fire protective devices
___Air balance

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.9 Name Heating, Ventilating & Cooling

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION

Boilers; Radiation; Solar heating; Ductwork and piping; Fans; Heat pump; Fan coil units; Air handling units; Packaged rooftop A/C; Packaged water chillers; Cooling tower; Computer room cooling

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

B.10. PLUMBING SYSTEMS CHECKLIST

Components: Piping, valves, and traps; Controls; Pumps; Water storage; Plumbing fixtures; Drinking fountains; Sprinkler systems.

GENERAL INSPECTION

Building user comments _____

Occupied spaces:

General appearance: ___Good ___Fair ___Poor

Leaks, dripping, running faucets and valves _____

Maintenance history _____

Supply adequacy _____

Sanitation hazards _____

Drain & backflow protection _____

Cross connections _____

Fixture quantity _____

Fixture types & conditions _____

Disabled and impaired fixtures _____

Female facilities _____

Metal pipe & fittings corrosion _____

Pipe joints & sealing _____

Hanger supports & clamps _____

Filters _____

WATER SYSTEM

___Water pressure adequate
___Odors, tastes
___Main cutoff operable
___Water heating temperature setting
___Pump condition
___Insulation condition
___Water quality

SANITARY & STORM SYSTEM

___Flow adequate
___Cleanouts access
___Floor drains
___Chemical resistance
___Gradient
___On-site disposal system

CODE REQUIREMENTS

___EPA/local permits
___Other

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FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.10 Name Plumbing Systems

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION

Piping, valves, and traps; Controls; Pumps; Water storage; Plumbing fixtures; Drinking fountains; Sprinkler systems

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

B.11. ELECTRICAL SERVICE CHECKLIST

Components: Underground and overhead service; Duct bank; Conduits; Cable trays; Underfloor raceways; Cables and bus ducts; Switchgear; Switchboard; Substations; Panelboards; Transformers.

GENERAL INSPECTION

Building user comments _____

Safety conditions _____

Service capacity, % used, and age _____

Switchgear capacity, % used, and age _____

Feeder capacity, % used, and age _____

Panel capacity _____

Thermoscanning: Y __ N __ Date _____

Maintenance records available _____

Convenience outlets _____

EXTERIOR SERVICE

____Line drawing

Feed source:

___Utility/owned
___Above/below ground

Transformer:

___Transformer tested
___Transformer arcing or burning
___Transformer PCBs
___Ownership (*facility or utility*)

INTERIOR DISTRIBUTION SYSTEM

___Line drawing
___Incoming conduit marked
___Main circuit breaker marked
___Panel boards, junction boxes covered
___All wiring in conduit
___Conduit properly secured
___Panels marked
___Panel schedules
___Missing breakers

EMERGENCY CIRCUITS

Emergency generator(s):
___Condition and age
___Auto start and switchover
___Testing schedule
Test records available: Y__ N __
___Service schedule
Service schedule records available: Y __ N __
___Circuits appropriate
___Cooling & exhaust
___Fuel storage (capacity)

EMERGENCY LIGHTING/ POWER SYSTEMS:

Battery operation: Y __ N __
Separate power feed: Y __ N __
Exit signs: Y __ N __
Stairways/corridors: Y __ N __
Elevators: Y __ N __
Interior: Y __ N __
HVAC: Y __ N __
Exterior: Y __ N __

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.11 Name Electrical Service

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION

Underground and overhead service; Duct bank; Conduits; Cable trays; Underfloor raceways; Cables and bus ducts; Switchgear; Switchboard; Substations; Panelboards

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

B.12. ELECTRICAL LIGHTING CHECKLIST

Components: Lighting fixtures; Wiring; Motor controls; Motors; Safety switches; Telecommunications and data; Emergency/standby power; Baseboard electric heat; Lightning protection.

GENERAL INSPECTION

Building user comments _____

Lighting Levels:

___Adequate ___Excessive ___Inadequate

Evenness of distribution _____

Fixture condition

Flickering of units: Y __ N __

Location _____

Buzzing, humming, or other sounds _____

Lens condition _____

Emergency lighting _____

Exit lighting _____

Code compliance _____

WIRING, WALL SWITCHES, LIGHTING FIXTURES

___Cover plates in place
___Junction boxes covered
___All wire in conduit
___Sufficient outlets provided
___GFI circuit breakers
___Grounded wiring
___All switches operational _____

Cleaning, maintenance, repair, and replacement:

_____

_____

_____

_____

_____

_____

_____

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.12 Name Electrical Lighting

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION

Lighting fixtures; Wiring; Motor controls; Motors; Safety switches; Telecommunications and data; Emergency/standby power; Baseboard electric heat; Lightning protection

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

B.13. CONVEYING SYSTEMS CHECKLIST

Components: Dumbwaiters; Elevators; Escalators; Material handling systems; Moving stairs and walks; Pneumatic tube systems; Vertical conveyors.

GENERAL INSPECTION
(Passenger Conveying)

Building user comments _____

Maintenance history _____

Inspection frequency _____

Overall appearance (Interior) ___Good ___Fair ___Poor

Overall appearance (Exterior) ___Good ___Fair ___Poor

Door operations _____

Control systems _____

Noise _____

Code compliance _____

Disabled and impaired access _____

Major repairs necessary _____

Replacement necessary _____

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.13 Name Conveying Systems

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Dumbwaiters; Elevators; Escalators; Material handling systems; Moving stairs and walks; Pneumatic tube systems; Vertical conveyors

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

B.14. OTHER SYSTEMS

Components: Energy control systems; Clock systems; Public address systems; Sound systems; TV systems; Satellite dishes; Communications networks; etc.

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.14 Name Other Systems

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Energy control systems; Clock systems; Public address systems; Sound systems; Satellite dishes; Communications networks; etc.

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

B.15. SAFETY STANDARDS CHECKLIST

Components: Asbestos; Code compliance; Detection and alarm systems; Disabled accessibility; Emergency lighting; Egress—travel distance, exits, etc.; Fire ratings; Extinguishing and suppression; Hazardous and toxic material storage.

GENERAL INSPECTION

Building user comments _____

Code compliance _____

Maintainability _____

Means of egress _____

Fire ratings _____

Audible & visual device condition _____

Extinguishing systems (See also B.10. Plumbing):

___Type ___Condition

Lighting system (See also B.11. Electrical Lighting):

___Type ___Condition

Disabled and impaired accessibility

EXTERIOR LIGHTING

Adequacy:

___Good ___Fair ___Poor

Condition _____

Controls (type & location) _____

FIRE ALARM SYSTEMS

Panel visible: Y ___ N ___
Operational: Y ___ N ___

___Pull station condition
___Detector condition

STAIRS AND RAMPS

Exits marked _____

Hardware operational _____

Tripping hazards _____

Surface conditions _____

Lighting adequate _____

Handrails _____

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # B.15 Name Safety Standards

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Asbestos; Code compliance; Detection and alarm systems; Disabled accessibility; Emergency lighting; Egress— travel distances; exits, etc.; Fire ratings; Extinguishing and suppression; Hazardous and toxic material storage

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

C. 1. SITE WORK CHECKLIST

Components: Roads, walks, parking lots; Curbing; Drainage and erosion control; Parking lot control; Fencing; Athletic and other recreation facilities.

GENERAL INSPECTION

Note comments on following where applicable:

Overall appearance

Good _____ Fair _____ Poor _____

Maintainability _____

Repairs/replacements _____

Code compliance _____

ROADS, WALKS, AND PARKING LOTS

Surface conditions _____

Subsurface conditions _____

Settling and uplift _____

Cracks, holes _____

Drainage and slope _____

CURBING

Alignment _____

Erosion _____

Repairs/replacements _____

DRAINAGE AND EROSION CONTROL

Surface drainage _____

Manholes, inlets, catch basins _____

Vegetation _____

Channels, dikes _____

Retention, detention _____

Drains _____

C.1, *continued*

PARKING LOT CONTROLS

Location _____

Operation _____

Repairs/replacements _____

ATHLETIC AND OTHER RECREATION FACILITIES

(*See structural materials and finishes in lists B.2 and B.3*)

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # C.1 Name Site Work

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Roads, walks, parking lots; Curbing; Drainage and erosion control; Parking lot control; Fencing; Athletic and other recreation facilities

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

C.2. LANDSCAPING CHECKLIST

Components: Lawns; Planting; Trees; Shrubs.

GENERAL INSPECTION

Note comments on following where applicable:

Overall appearance:

___Good ___Fair ___Poor

Location _____

Size adequacy _____

Condition _____

Maintainability _____

Protection from equipment _____

Pruning _____

Disease and pest control _____

Fertilizing _____

Containers, gratings, planter boxes _____

Repairs/replacements _____

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # C.2 Name Landscaping

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Lawns; Planting; Trees; Shrubs

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

C.3. STRUCTURES CHECKLIST

Components: Bridges; Culverts; Retaining walls; Tunnels; Ornamental features: sculpture, fountains, memorials, etc.; Antennae; Satellite dishes.

GENERAL INSPECTION

Note Comments on following where applicable (See also B.1 and B.2):

Overall appearance:

___Good ___Fair ___Poor

Maintainability _____

Repairs/replacements _____

Foundations/anchoring _____

Structural condition _____

Surface condition _____

Safety/access _____

Drainage _____

Joints/groundwater leaks _____

Ventilation/lighting _____

Size adequacy/capacity _____

Code compliance _____

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # C3 Name Structures

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Bridges; Culverts; Retaining walls; Tunnels; Ornamental features: sculpture, fountains, memorials, etc.; Antennae; Satellite dishes

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures			
Def #	Description	Rating	Craft	Labor$	+ Mat'l$	= Total Cost

C.4 . UTILITIES CHECKLIST

Components: Central utility systems; Energy distribution systems; Electrical distribution systems; Piping systems: compressed air, distilled water, domestic water, high and low temperature water, storm drainage, sanitary sewage, irrigation systems; Site lighting; Water treatment and distribution systems; Wastewater treatment and collection systems. (See also B.9 – B.12)

GENERAL INSPECTION

Note comments on following where applicable:

Size capacity/adequacy _____

Structural condition _____

Maintainability _____

Repairs/replacements _____

Code compliance/certifications _____

CENTRAL UTILITY SYSTEMS

Energy plants:

Boilers _____

Turbines _____

Chillers _____

ENERGY DISTRIBUTION SYSTEMS

Steam and condensate returns _____

High and low temperature water _____

Chilled water _____

Natural gas _____

ELECTRICAL DISTRIBUTION SYSTEMS

Substations _____ Fencing _____

Transformers _____ Structures _____

Relays _____ Feeders _____

Meters _____ Wiring _____

C.4, *continued*

PIPING SYSTEMS
(Chilled water, distilled water, domestic water, irrigation, sanitary, storm)

Joints, trap _____ Manholes _____

Valves, flanges _____ Grates _____

Controllers _____ Backflow preventers _____

Piping _____ Meters _____

Pumps _____

SITE LIGHTING

Lamps _____

Wiring _____

Controls _____

WATER TREATMENT AND DISTRIBUTION SYSTEMS

WASTEWATER TREATMENT AND COLLECTION SYSTEMS

FACILITY AUDIT INSPECTION REPORT

STANDARD INSPECTION FORM

1. FACILITY INSPECTION DATA

Facility: # _____ Name _____

Component: # C.4 Name Utilities

Inspector: _____ Date: _____

2. COMPONENT DESCRIPTION Central utility systems; Energy distribution systems; Electrical distribution systems; Piping systems: compressed air, distilled water, high and low temperature water, storm drainage, sanitary sewage, irrigation systems; Site lighting; Water treatment and distribution systems; Wastewater treatment and collection systems (See also B.9 – B.12)

3. COMPONENT EVALUATION:

Deficiency		Priority	Corrective Measures
Def #	Description	Rating	Craft Labor$ + Mat'l$ = Total Cost

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D.1. SUITABILITY AND ADAPTABILITY

1. FACILITY INSPECTION DATE

Facility Name _____ Facility # _____

Inspector _____ Date _____

2. COMPONENT DESCRIPTION

Flexible design concept _____

_____

Partitions (Demountable or rigid) _____

_____

Specialized building type _____

_____

Flexible service systems _____

_____

Stationary equipment _____

_____

Functional spaces _____

_____

Working environment _____

_____

Circulation and functional relationships _____

_____

Conflicting uses _____

_____

Code conformance _____

_____

Disabled accessibility _____

_____

Deferred maintenance _____

_____

3. COMMENTS _____

_____

D.2. USE CONSIDERATIONS

1. FACILITY INSPECTION DATA

Facility Name _____ Facility # _____

Inspector _____ Date _____

2. COMPONENT DESCRIPTION

Traditional Values	Significant role or meaning relative to practices or values.
Historic Values	Significance to the institution or community for historic associations similar to National Register of Historic Places criteria.
Aesthetic Values	Visual qualities and physical relationships with other buildings or the landscape.
Social/Community Values	Benefits or detriments to location and/or community.
Interim Use	Other temporary uses of facility.
Future Land Use	Conflicting land use with future plans.
Suitability	Spatial characteristics relative to specific use or suitability specialized use difficult to replace.
Intangible Values	Orientation, psychological environment, noise, odors, etc.

3. COMMENTS _____

APPENDIX B

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